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THE 6502 JOURNAL



No. 28

SEPTEMBER

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Games, Games, Games

"Words, words, words! I'm so sick of words" is the start of a song sung by Liza Doolittle in *My Fair Lady*. In this song she expresses her despair at the interest in words to the exclusion of other matters. I can fully understand her feelings. She feels that there is a lot more to life than just the "words" on which Professor Higgins spends all of his time. In a very similar vein, I feel that there is a lot more potential to the microcomputer than its popular use as an entertaining game-playing device. This is not to say that I am totally against computer games. Actually, I see nothing "illegal, immoral, or fattening" in using computer games for pure enjoyment. If a game can be used to interest people in the computer and/or help to teach them something, all the better. My complaint is that all too often, "The Game" is the exclusive use of the computer and the exclusive interest of the user.

I believe that the game glut poses two serious problems. First, I personally believe that one of the most fundamental problems of our modern society is the isolation of the individual. While there are obviously a large number of factors involved, the fact that individuals spend a large portion of their time watching television (the current figure just announced is 7.25 hours of television per day!) must be significant. It bothers me to see a majority of microcomputer users spending their time playing solitary computer games. While this is probably better than passively watching the TV, it does not do much to encourage social contact or interaction. Is the main impact of this fantastic microcomputer revolution going to be greater dependence on machine based interaction and less on interpersonal interaction? Given the natural interest in games, why not invent computer based games to be played by more than one individual. The computer could either be one more player (the elusive "fourth

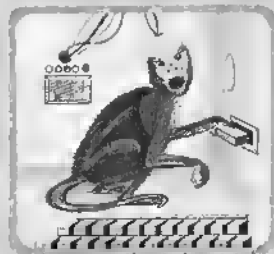
for bridge") or could provide a dynamic environment for games which are played exclusively by the human participants. While a few games are available along these general lines, by far the most common types of games are the one-on-one: one human against one microcomputer.

The second aspect of my "Games, games, games" complaint is that there are so many other uses of the microcomputer waiting to be discovered, but most of the potential discoverers are too busy playing games to consider alternative uses. Somewhere in the vast pool of new computerists there must be some individuals who could become the Einstein of the computer world. There is room for revolutionary improvements in the programming and application of computers. If the new computerists, who are being introduced to the microcomputer via games, get trapped into the game playing habit, then who will make the new discoveries and exciting improvements?

I have no simple solution. Since computer games are fun, many people are going to spend all of their computer time and money playing them. MICRO is going to be starting several series of articles in the coming months that will try to show how productive work can be as exciting and challenging as games, and vastly more rewarding. In the meantime, you should seriously consider how you are using your equipment, your time, and your money. Isn't it perhaps time that you started contributing to this field, instead of just playing around in it?

Robert M. Taylor

MICRO



**MICRO in the Lab
Cover Artist
Terry Spiilane**

Is that a crown that Lana is wearing? What did our Simian ancestor do to receive such royal treatment? Lana has demonstrated the rudiments of linguistic competence — the "crown" is an array of electronic sensors which are used to learn more about the phenomenon Lana has displayed.

While our Lana is fictitious, the scene depicted on our cover is based on an actual experiment. A chimpanzee named Lana has been taught to communicate with a small computer, using a special picture language.

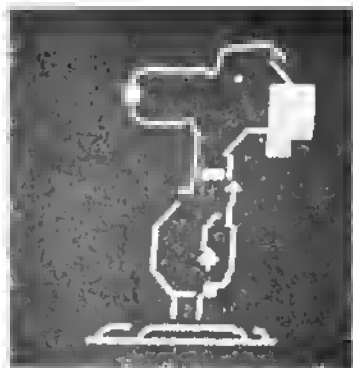
Using a computer as the medium for the picture language, the designers of the Lana experiment have attained some significant advantages. The computer allows 24-hour monitoring and mass data

storage. Only ten years ago, the equipment needed for this experiment would have taken up half a room and it would have cost over \$10,000. Now, however, a simple single board Microprocessor (like the KIM-1) has more than enough processing power for such a task. Perhaps even more importantly, the computer can easily analyze sentences in a phrase-structure language for correct form. Actually, your Micro does this each time you run a basic program!

The Microcomputer's place in the lab has become well established; the Lana experiment is just one example. The next few years should see Micros being used in even more innovative ways in the lab...perhaps soon a Micro may even be generating, rather than monitoring, language!

μ

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Creating Shape Tables, Improved!

~~~~~  
**Building a Shape Table for use with the Apple HI-RES Graphics can be a painful task. This Improved Shape Making Routine turns the pain into pleasure.**  
~~~~~

Peter A. Cook
1443 N. 24th St.
Mesa, AZ 85203

Three cheers to John Figueras for unraveling the mysteries of the Apple shape table in MICRO 19:11. His article presented an extremely useful tool for creating shapes, and greatly simplified a task which had been so difficult and time consuming as to be hardly worth the effort.

After using the Figueras programs a few times, it became apparent that they would be much more convenient if they were combined into one large program. Also, they contained several minor errors which needed correcting. This article describes changes and corrections which greatly increase the usefulness of the original programs.

Combined Program

Combining the programs for initializing, creating, and displaying shape tables into one large program eliminates the need for typing the name of the next program each time you need to load it from the disk, and then waiting for it to be loaded. It also eliminates the need to continually re-enter the name and starting address of the desired shape table, and the subsequent wait for it to be loaded.

I combined the three original programs by treating them as subprograms. Since they all used

similar line numbers, they required extensive renumbering. This was easy to accomplish using the 'Renumber' program found on the DOS 3.2 master diskette. The numbers were not done consecutively in order that the last two digits would remain the same as in the original programs in most cases. The new line numbers correspond to the old ones roughly as follows: title page, 100-150; initialize, 1000-1300; create shapes, 2000-3300; and display shapes, 4000-4500.

Title Page

The program begins by listing the title information and then by automatically loading the numerals shapefile. I have used the term 'shapefile' throughout the program to denote a shape table which has been stored as a disk file, as opposed to one which merely resides in RAM.

The program has been converted for use with a single disk drive by omitting the volume and drive numbers from the disk commands, because with the prices of drives being what they are, I would venture to say that most of us have only one.

A short menu then appears, which allows selection of any of the three subprograms, or termination of the program.

Initializing Subprogram

The greatest change made in this subprogram was the removal of the steps for producing the cursor. Placing the cursor into every shape table as the first shape in each one was wasteful of space, and very confusing. The cursor is always available as the first shape in the numerals shapefile, which is loaded when the program begins. Details of the numerals shapefile will be covered later. By using the improved program, your tables will now contain only the desired shapes, and will start with number one instead of number two.

Because of the removal of the cursor, line 1060 now adds a few more zeros so that the starting address of the first empty shape will contain a zero end-of-record mark. Line 1090 now calculates the index to the first shape instead of to the cursor. The variable ADDR had to be changed to ASVE to make it compatible with the shape creating subprogram.

Lines 1260-1300 were changed to let you know that the computer is doing what it is supposed to do, and to ask if you want to save the file on disk at this time. You can save time by waiting until the end of the shape creating subprogram before storing the shape table on disk.

The menu is then repeated at the

bottom to avoid having to return to the title page.

Shape Creating Subprogram

This subprogram assumes that you are still working with the same shape table that you initialized in the previous subprogram, and shows you what its name and starting address are. In case you want to work on a different shapefile which was previously stored on the disk, allowance is made for entering its name and address. The desired shape table is then loaded into its proper location.

The computer then checks to see if there is any space left for more shapes in that table. If not, it so advises you and tells you the address of the next free byte after the end of the table. The original program attempted to do this, but actually it accessed the first two bytes of the cursor vectors instead of finding the zero end-of-record mark, and thus provided a meaningless number. Lines 2132-2262 include the changes to correct this.

Since the cursor is now located in a different shape table than the one with which you are currently working, the computer must be able to switch from one table to the other as needed, to line 2264 remembers the pointer for the new shape table, and uses it again in the line 3170.

The text at the bottom of the plotting grid has been improved by adding line 2350 to show the number for the shape you are currently working on. The limits of the starting coordinates are shown in lines 2360-2380, along with the fact that coordinates are measured from the upper left. Error checks were added to prevent entering coordinates located outside of the grid, which could stop the program in some instances.

The word "ERASE" was added to the list of keyboard commands LEFT, RIGHT, etc. In the original program, no checks were made on the values of x and y when entering L, R, U, or D, so if you accidentally exceeded certain grid boundaries the program would shut down. This was especially easy to do if you were using the "repeat" key to move the cursor. Lines 2600-2664 now

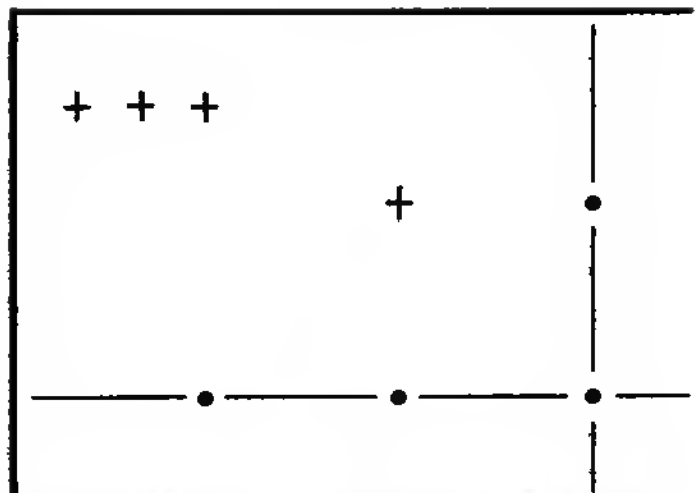


Figure 1. Upper left corner of the display grid, showing the starting points for the three possible digits of the shape number, and for the shape itself.

contain error checks which prevent the grid limits from being exceeded, and sound a beep if you attempt to do so.

The original program placed a permanent cursor mark in the starting position. This meant that there were always two cursor marks visible within the grid, which was

*4E20.4EDB

sometimes confusing. Line 2390 now places a large "+" in the starting square, the points of which are always visible around the outside of the cursor or around the outside of a plotted circle. The original program also attempted to give a reverse image of the cursor if it passed through a plotted circle. The succession of XDRAW commands,

```

4E20- 0B 00 18 00 1E 00 30 00
4E28- 3D 00 4C 00 5D 00 6D 00
4E30- 7D 00 8D 00 9B 00 AB 00
4E38- 3E 24 2D 36 04 00 DB DB
4E40- DB 24 0C 2D 15 17 35 36
4E48- 1E 3F 0F 18 0D 18 27 00
4E50- DB DB DB 08 5B 0D 18 36
4E58- 36 F6 2D 04 00 DB DB DB
4E60- 08 18 0C 2D 15 F6 BF 17
4E68- 2E 2D 25 00 DB DB DB 08
4E70- 18 2B 2D 35 1E 1E AD F6
4E78- 3F 0F 18 04 00 DB DB DB
4E80- 2E 2D B5 23 0C 18 24 BC
4E88- 0A 18 17 04 00 DB DB DB
4E90- 12 0E 2D 0D 18 24 1C 3F
4E98- 27 2C 2D 25 00 DB DB DB
4EA0- 32 0E 2D 0D 18 E4 3F 27
4EAB- 0C 0C 2D 04 00 DB DB DB
4EB0- 08 18 2B 2D 35 1E 1E 1E
4EB8- 36 04 00 DB DB DB 20 0C
4EC0- 2D 15 F6 3F 17 78 2D 0D
4ECB- 1B 24 00 DB DB DB 92 2D
4ED0- 0D 18 0D 1B 24 E4 3F 17
4ED8- 76 2D 04 00

```

Figure 2. Hex pairs of the numerals shape table.

however, was incorrect for all combinations of plotting, erasing, and passing through the starting position. Changes were made in lines 2680, 2740, 3040 to correct this. Now it is always obvious where the cursor is located and where the starting position is located.

The erase command is only effective immediately following a plot command. There is a way to erase any other plotted point, however, and that is by simply plotting over top of a point which has already been plotted. This will not erase the circle plotted in the grid, but the point will not appear in the finished shape when it is drawn to the right of the grid after the quit command.

In the original program, the warning "SHAPE TABLE FULL WITH THIS SHAPE" appeared both after the second-last shape as well as after the last shape. Changing N to N-1 in line 3230 allows the warning to appear only after the last shape.

The menu is repeated again at the bottom to allow selection of any other subprogram, to to run the same one again.

Shape Display Subprogram

This subprogram starts out as the previous one did, by listing the name and address of the shapefile you are currently working with. If you wish to display a different one, enter its name and address.

Some variable names were changed to keep them compatible with the rest of the program. ADDR was changed to ASVE, and NN was changed to N. In line 4114 (line 70 in the original) NL was changed to NLO, although either variable is acceptable since Applesoft only recognizes the first two characters of a variable name.

In the original program the screen went black after the shapefile was loaded, and you had to remember to press any key to start the display. Line 4150 keeps the instruction on the screen until you need it, and line 4202 takes you immediately into the first page of the display.

The grid lines created by the original program had an odd dot pattern which was not very useful

because it didn't show where the starting positions of the shapes were located. Lines 4250-4310 were changed to present the dot pattern shown in Figure 1.

Pressing any key after the last page of the display puts the menu back on the screen.

Numerals Shapefile

In order to use the above program, the 'numerals' shape table must already have been stored on the disk in order to have the cursor available. If this has not been done, it will be necessary to load the shape table using either of the two following methods.

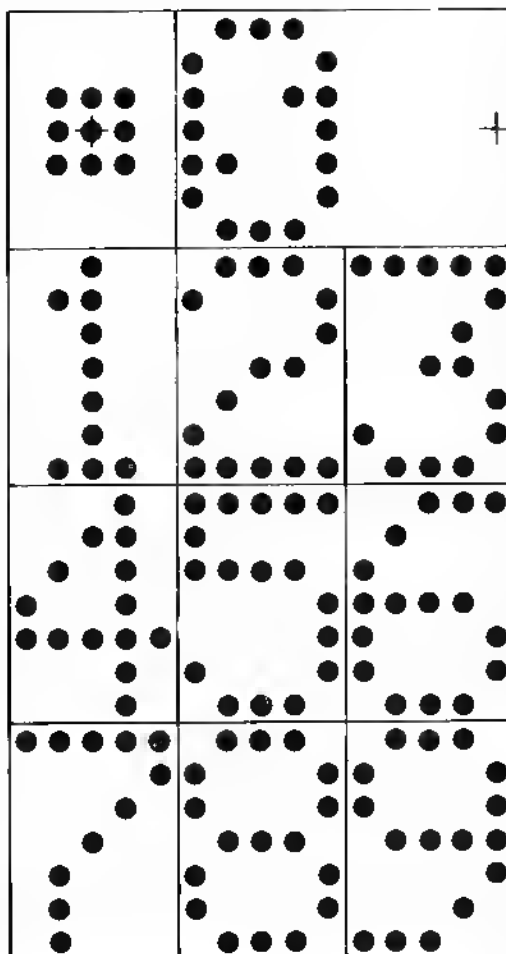


Figure 3. Cursor and numerals. The starting point is in the center of the cursor, and five spaces to the right of all the numerals.

Figure 2 lists the hex values of the entire numerals shape table. It can be placed in RAM by entering the monitor mode, typing the addresses at the left, such as 4E20, followed by a colon, followed by each two-character element separated by a space. Since there are 188 elements, this may take some time. When you have finished, don't forget to save what you just typed before you run the program. Use BSAVE SHAPEFILE NUMERALS, A20000, L188.

The numerals are of the same design as the Apple numerals and are depicted in Figure 3. The starting point was placed five spaces to the right of each numeral, so that the finished numeral will be shifted off to the left of the shape which is displayed in the same block with it.

Another method is to type in just enough of the shape table to have the cursor available, and then to form your own numerals by using the shape creating subprogram. To do this, POKE each of the values in Figure 4 into its proper location by using the format POKE 20000, 1. Transfer it to the disk using BSAVE SHAPEFILE NUMERALS, A20000, L30. Then run the program and select the shape creating subprogram. Enter the name SHAPEFILE NUMERALS, and the address 20000. Form all of the digits in the order zero through nine by following the instructions on the screen, and then you will be ready to create and display other shape tables.

Conclusion

The program listing is presented on the following pages. In order to save space, all remarks were removed except for a title at the beginning of each subprogram. Basically, the same remarks apply as published in the original article.

In closing, I would like to thank John Figueras for providing Apple users with a most useful addition to their repertoire of utility programs.

μ

Location	Value	Description
----------	-------	-------------

~~~~~  
 Major Peter Cook is a jet pilot instructor at Williams Air Force Base in Arizona. He uses his Apple II to simulate aircraft scheduling problems at work, and designs games for his kids at home. This is his second article for MICRO.  
 ~~~~~

20000	1	Number of shapes completed
20001	0	
20002	24	Location in table, starting address + 24
20003	0	
20024	62	Cursor vectors
20025	36	Cursor vectors
20026	45	Cursor vectors
20027	54	Cursor vectors
20028	4	Cursor vectors
20029	0	Zero end-of-record mark

Figure 4. Minimum entries for producing the cursor in the numerals shape table.

```

144 IF VAL (IN$) < 1 OR VAL (I
N$) > 4 THEN UTAB 23: HTAB
19: PRINT " ": GOTO 140
146 ON VAL (IN$) GOTO 1010,2010
,4010,150
150 TEXT : HOME : END
1000 REM INITIALIZE.
1010 TEXT : HOME : PRINT "INITIA
LIZE NEW SHAPEFILE"
1020 PRINT : PRINT " NAME OF NE
W SHAPEFILE": INPUT " ?";NA
ME$
1030 PRINT : PRINT " STARTING A
DDRESS (DECIMAL)": INPUT "
?";ASVE
1040 PRINT : PRINT " NUMBER OF
SHAPES TO BE STORED IN FILE"
: INPUT " ?";N
1060 FOR I = 0 TO 2 * N + 3
1070 POKE ASVE + I,0: NEXT
1090 N = 2 * N + 2
1110 POKE ASVE + 2,N - 256 * INT
(N / 256)
1120 POKE ASVE + 3, INT (N / 256
)
1260 PRINT : PRINT "SHAPEFILE IN
ITIALIZED"
1280 INPUT " SAVE ON DISK (Y/N)
? ";IN$: IF IN$ < > "Y" THEN
1310
1290 PRINT D$;"BSAVE ";NAME$;","
A";ASVE;"," L";N + 1
1300 PRINT : PRINT "SAVED"
1310 UTAB 21: PRINT "1 INIT 2
CREATE 3 DISPLAY 4 END"
1320 GOTO 140
2000 REM CREATE SHAPES.
2010 I = 0: TEXT : HOME : PRINT "
CREATE NEW SHAPES IN SHAPEFI
LE"
2020 PRINT : PRINT "CURRENT SHAP
EFILE AND ADDRESS:"
2030 PRINT : HTAB 3: PRINT NAME$
2040 PRINT : HTAB 3: PRINT ASVE
2050 PRINT : PRINT : PRINT "FOR
NO CHANGE, PRESS RETURN:"
2070 PRINT : INPUT " DIFFERENT
FILE? ";IN$: IF LEN (IN$) =
0 THEN 2080

```

LIST

```

100 REM SHAPEFILE CREATE/DISPLAY
P. COOK, JAN 1980
ADAPTED FROM J. FIGUERAS
MICRO MAGAZINE, DEC 1979
110 HOME : PRINT : PRINT "*****
*****"
112 HTAB 9: PRINT "SHAPEFILE CRE
ATE/DISPLAY"
114 PRINT : HTAB 12: PRINT "P. C
OOK, JAN 1980"
116 HTAB 9: PRINT "ADAPTED FROM
J. FIGUERAS"
118 HTAB 9: PRINT "MICRO MAGAZIN
E, DEC 1979"
120 PRINT : PRINT "*****
*****"
122 D$ = CHR$ (4): PRINT D$;"NOM
ON C,I,O": PRINT D$;"LOAD S
HAPEFILE NUMERALS"
130 UTAB 13: HTAB 6: PRINT "1 I
NITIALIZE SHAPEFILE"
132 PRINT : HTAB 6: PRINT "2 CR
EATE SHAPES"
134 PRINT : HTAB 6: PRINT "3 DI
SPLAY SHAPES"
136 PRINT : HTAB 6: PRINT "4 EN
D"
140 UTAB 23: INPUT "SELECT (1/2/
3/4)? ";IN$

```

```

2075 NAME$ = IN$:I = 1
2080 PRINT : INPUT " DIFFERENT
ADDRESS? ";IN$: IF LEN (IN$
) = 0 THEN 2100
2085 ASUE = VAL (IN$):I = 1
2100 IF I = 0 THEN 2130
2110 PRINT 0$;"BLOAD ";NAME$;" ,
A";ASUE
2130 MAX = PEEK (ASUE + 2) + 256
* PEEK (ASUE + 3)
2132 FB = ASUE + PEEK (ASUE + MA
X - 2) + 256 * PEEK (ASUE +
MAX - 1)
2140 MAX = (MAX - 2) / 2
2160 N = PEEK (ASUE)
2220 IF MAX > N THEN 2260
2222 IF PEEK (FB) < > 0 THEN F
B = FB + 1: GOTO 2222
2224 FB = FB + 1
2230 PRINT : PRINT : PRINT "SHAP
E TABLE FULL, NEXT FREE BYTE
";FB
2240 GOTO 1310
2260 INDEX = PEEK (ASUE + 2 * N +
2) + 256 * PEEK (ASUE + 2 *
N + 3)
2262 ADDR = ASUE + INDEX
2264 AHI = INT (ASUE / 256):ALO =
ASUE - 256 * AHI: POKE 232,A
LO: POKE 233,AHI
2280 N = N + 1: POKE ASUE,N
2300 HCOLOR= 3: SCALE= 1: ROT= 0
:CYCLE = 0
2310 HGR
2320 FOR X = 0 TO 150 STEP 10: HPLT
X,0 TO X,150: NEXT
2330 FOR Y = 0 TO 150 STEP 10: HPLT
0,Y TO 150,Y: NEXT
2350 HOME : UTAB 21: PRINT "SHAP
E NUMBER ";N;" OF ";MAX
2360 PRINT "ENTER STARTING COORD
S (UPPER LEFT 1,1)"
2370 INPUT "X (1-15)? ";X: IF X <
1 OR X > 15 THEN 2370
2372 X = 10 * X - 5
2380 INPUT "Y (1-15)? ";Y: IF Y <
1 OR Y > 15 THEN 2380
2382 Y = 10 * Y - 5
2390 HPLT X,Y - 4 TO X,Y + 4: HPLT
X - 4,Y TO X + 4,Y:XS = X:YS
= Y
2410 PRINT : PRINT : PRINT : PRINT
2420 PRINT "MOVE CURSOR WITH KEY
S"
2430 PRINT " L-LEFT R-RIGHT U
-UP D-DOWN"
2440 PRINT " P-PLOT E-ERASE 0
-QUIT"
2450 POKE 232,32: POKE 233,78
2460 KEY$ = "":KSUE$ = "": GOTO 2
570
2480 IF FLAG = 1 THEN 2520
2500 XDRAW 1 AT X1,Y1
2520 X1 = X:Y1 = Y:FLAG = 0
2530 XDRAW 1 AT X,Y
2550 KI$ = KSUE$:KSUE$ = KEY$
2570 GET KEY$
2590 IF KEY$ < > "U" THEN 2610
2600 SYMBOL = 0:Y = Y - 10: IF Y <
5 THEN Y = Y + 10: GOTO 2664
2602 GOTO 2760
2610 IF KEY$ < > "R" THEN 2630
2620 SYMBOL = 1:X = X + 10: IF X >
145 THEN X = X - 10: GOTO 26
64
2622 GOTO 2760
2630 IF KEY$ < > "D" THEN 2650
2640 SYMBOL = 2:Y = Y + 10: IF Y >
145 THEN Y = Y - 10: GOTO 26
64
2642 GOTO 2760
2650 IF KEY$ < > "L" THEN 2670
2660 SYMBOL = 3:X = X - 10: IF X <
5 THEN X = X + 10: GOTO 2664
2662 GOTO 2760
2664 UTAB PEEK (37): PRINT CHR$
(7): GOTO 2570
2670 IF KEY$ < > "P" THEN 2690
2680 FLAG = 1: GOSUB 3000: GOTO 2
520
2690 IF KEY$ = "Q" THEN 3100
2710 IF KEY$ < > "E" THEN 2570
2720 HCOLOR= 0:FLAG = 0: GOSUB 3
000
2740 KSUE$ = KI$: HCOLOR= 3: GOTO
2530
2760 IF KSUE$ = "P" THEN SYMBOL =
SYMBOL + 4
2780 CYCLE = CYCLE + 1
2790 IF CYCLE < > 1 THEN 2810
2800 BYTE = SYMBOL: GOTO 2480
2810 IF CYCLE < > 2 THEN 2900
2820 BYTE = BYTE + 8 * SYMBOL
2840 IF BYTE > 7 THEN 2480
2860 BYTE = BYTE + 8: POKE ADDR,B
YTE:ADDR = ADDR + 1
2880 BYTE = 24:CYCLE = 2: GOTO 24
80
2900 IF SYMBOL > 3 THEN 2930
2910 BYTE = BYTE + 64 * SYMBOL
2930 POKE ADDR,BYTE:ADDR = ADDR +
1

```



```

2950 IF SYMBOL = 0 OR SYMBOL > 3
    THEN 2980
2970 CYCLE = 0: GOTO 2480
2980 CYCLE = 1: BYTE = SYMBOL: GOTO
    2480
3000 FOR Y2 = Y - 3 TO Y + 3 STEP
    6: H PLOT X - 1, Y2 TO X + 1, Y
    2: NEXT
3010 FOR Y2 = Y - 2 TO Y + 2 STEP
    4: H PLOT X - 2, Y2 TO X + 2, Y
    2: NEXT
3020 FOR Y2 = Y - 1 TO Y + 1: H PLOT
    X - 3, Y2 TO X + 3, Y2: NEXT
3040 RETURN
3080 IF KSUE$ < > "P" THEN 3150

3100 IF CYCLE < > 2 THEN 3120
3110 POKE ADDR, BYTE: ADDR = ADDR +
    1
3120 IF CYCLE < > 1 THEN 3140
3130 BYTE = BYTE + 32: GOTO 3150
3140 BYTE = 4
3150 POKE ADDR, BYTE: ADDR = ADDR +
    1
3170 POKE ADDR, 0: ADDR = ADDR + 1
    : POKE 232, ALO: POKE 233, AHI
    : XDRAW N AT 200, 75
3180 INPUT "SAVE SHAPE (Y/N)? ";
    KI$
3190 IF KI$ = "Y" THEN 3220
3200 N = N - 1: GOTO 2280
3220 N = N + 1: ADDR = ADDR - ASVE

3230 IF N - 1 < MAX THEN 3270
3240 PRINT "WARNING - TABLE FULL
    WITH THIS SHAPE"
3250 IF N > MAX THEN 3310
3270 POKE ASVE + 2 * N, ADDR - 25
    6 * INT (ADDR / 256)
3280 POKE ASVE + 2 * N + 1, INT
    (ADDR / 256)
3290 INPUT "DONE (Y/N)? "; KI$
3300 IF KI$ = "N" THEN 2160
3310 INPUT "SAVE SHAPEFILE (Y/N)
    ? "; KI$
3330 IF KI$ = "Y" THEN 3360
3340 IF KI$ = "N" THEN 3370
3350 GOTO 3310
3360 PRINT 0$; "BSAVE "; NAME$; ",
    A"; ASVE; ", L"; ADDR
3370 HOME : GOTO 1310
4000 REM DISPLAY SHAPES.
4010 I = 0: TEXT : HOME : PRINT "
    DISPLAY SHAPES IN SHAPEFILE"

4020 PRINT : PRINT "CURRENT SHAP
    EFILE AND ADDRESS:"
4030 PRINT : HTAB 3: PRINT NAME$

4040 PRINT : HTAB 3: PRINT ASVE
4050 PRINT : PRINT : PRINT "FOR
    NO CHANGE, PRESS RETURN:"

4070 PRINT : INPUT " DIFFERENT
    FILE? "; IN$: IF LEN (IN$) =
    0 THEN 4080
4075 NAME$ = IN$: I = 1
4080 PRINT : INPUT " DIFFERENT
    ADDRESS? "; IN$: IF LEN (IN$
    ) = 0 THEN 4100
4085 ASVE = VAL (IN$): I = 1
4100 IF I = 0 THEN 4114
4110 PRINT 0$; "BLOAD "; NAME$; ",
    A"; ASVE
4114 NHI = 78: NLO = 32
4120 AHI = INT (ASVE / 256): ALO =
    ASVE - 256 * AHI
4140 N = PEEK (ASVE)
4150 UTAB 23: PRINT "PRESS SPACE
    BAR FOR EACH PAGE OF TABLE"
    : GET KEY$
4160 HGR : POKE - 16302, 0
4170 HCOLOR= 3: SCALE= 1: ROT= 0

4180 FOR I = 1 TO N
4190 IMOD = I - 36 * INT (I / 36
    )
4200 IF IMOD < > 1 THEN 4350
4202 IF I = 1 THEN 4240
4210 GET KEY$
4240 CALL 62450
4250 H PLOT 0, 0 TO 270, 0 TO 270, 1
    80 TO 0, 180 TO 0, 0
4260 FOR L = 45 TO 225 STEP 45
4270 FOR J = 15 TO 165 STEP 15
4280 H PLOT L, J
4290 NEXT J, L
4300 FOR L = 30 TO 150 STEP 30
4310 FOR J = 15 TO 255 STEP 15
4320 H PLOT J, L
4330 NEXT J, L
4350 IF IMOD = 0 THEN IMOD = 36
4360 ROW = INT ((IMOD - 1) / 6)
4370 COL = IMOD - 6 * ROW - 1
4380 C1 = INT (I / 100)
4390 C2 = I - 100 * C1
4400 C2 = INT (C2 / 10)
4410 C3 = I - 10 * INT (I / 10)
4420 POKE 232, NLO: POKE 233, NHI
4430 C1 = C1 + 2: C2 = C2 + 2: C3 =
    C3 + 2
4440 IF C1 = 2 THEN 4460
4450 DRAW C1 AT 45 * COL + 5, 30 *
    ROW + 7
4460 IF C2 = 2 AND C1 = 2 THEN 4
    480
4470 DRAW C2 AT 45 * COL + 10, 30
    * ROW + 7
4480 DRAW C3 AT 45 * COL + 15, 30
    * ROW + 7
4500 POKE 232, ALO: POKE 233, AHI
4510 DRAW I AT 45 * COL + 30, 30 *
    ROW + 15
4520 NEXT I
4530 GET KEY$: TEXT : HOME : GOTO
    1310

```



Skyles Electric Works

Presenting the Skyles MacroTeA

Text Editor

To help you write your program, MacroTeA includes a powerful text editor with 34 command functions:

AUTO	Numbers lines automatically.
NUMBER	Automatically rennumbers lines.
FORMAT	Output text file in easy-to-read columnar
COPY	Copies a line or group of lines to a new location.
MOVE	Moves a line or group of lines to a new location.
DELETE	Deletes a line or group of lines.
CLEAR	Clears the text file.
PRINT	Prints a line or group of lines to the PET screen.
PUT	Saves a line or group of lines of text on the tape (or disc).
GET	Loads a previously saved line or group of lines of text from the tape (or disc).
DUPLICATE	Copies text file modules from one tape recorder to the other. Stops on specific modules to allow changes before it is duplicated. This command makes an unlimited length program (text file) optional.
HARD	Prints out text file on printer.
ASSEMBLE	Assembles text file with or without a listing. Assembly may be specified for the object code (program) to be recorded or placed in RAM memory.
PASS	Does second pass of assembly. Another command that makes unlimited length text files (source code) possible.
RUN	Runs (executes) a previously assembled program.
SYMBOLS	Prints out the symbol table (label file).
SET	Gives complete control of the size and location of the text file (source file), label file (symbol table) and relocatable buffer.
DISK	Gives complete access to the eleven DOS commands: PUT GET NEW INITIALIZE DIRECTORY COPY DUPLICATE SCRATCH VALIDATE RENAME ERROR REPORT
EDIT	Offers unbelievably powerful search and replace capability. Many large noncomputer assemblers lack this sophistication.
FIND	Searches text file for defined strings. Optionally prints them and counts them; i.e., this command counts number of characters in text file.
MANUSCRIPT	Eliminates line numbers on PRINT and HARD command. Makes MacroTeA a true and powerful Text Editor.
BREAK	Breaks to the Monitor or portion of MacroTeA return to Text Editor without loss of text file possible.
USER	Improves or repairs MacroTeA's Text Editor to user's needs. "Do-it-yourself" command.

Fast...Fast Assembler

Briefly, the pseudo-ops are:

- **BA** Commands the assembler to begin placing assembled code where indicated.
- **CE** Commands the assembler to continue assembly unless certain serious errors occur. All errors are printed out.
- **LS** Commands the assembler to start listing source (text file) from this point on.
- **LC** Commands the assembler to stop listing source (text file) from this point in the program.
- **CT** Commands the assembler to continue the source program (text file) on tape.
- **QS** Commands the assembler to store the object code in memory.
- **DC** Commands the assembler to not store object code in memory.
- **MC** Commands the assembler to store object code at location different from the location in which it is assembling object code.
- **SE** Commands the assembler to store an external address.
- **DS** Commands the assembler to set aside a block of storage.
- **BY** Commands the assembler to store data.
- **SI** Commands the assembler to store an internal address.
- **DE** Commands the assembler to calculate an external label expression.
- **DI** Commands the assembler to calculate an internal label expression.
- **EN** Informs the assembler that this is the end of the program.
- **EJ** Commands the assembler to jump to top of page on printer copy.
- **SET** A directive not a pseudo-op, directs the assembler to redefine the value of a label.

Macro Assembler

The macro pseudo-ops include:

MD	This is macro beginning instruction definition
ME	This is end of macro instruction definition
EC	Do not output macro-generated code in source listing.
ES	Do output macro-generated code in source listing.

Conditional Assembler

The conditional assembly pseudo-ops are:

IEQ	If the label expression is equal to zero, assemble this block of source code (text file).
INE	If the label expression is not equal to zero, assemble this block of source code (text file).
IPL	If the label expression is positive, assemble this block of source code.
IMI	If the label expression is negative, assemble this block of source code.
...	This is the end of a block of source code.

Enhanced Monitor

... By having 16 powerful commands:

A	Automatic MacroTeA cold start from Monitor.
Z	Automatic MacroTeA warm start from Monitor.
F	Loads from tape object code program.
S	Saves to tape object code between locations specified.
D	Disassembles object code back to source listing.
M	Displays in memory object code starting at selected location. The normal PET screen edit may be used to change the object code.
R	Displays in register. Contents may be changed using PET screen edit capabilities.
H	Hunts memory for a particular group of object code.
W	Allows you to walk through the program one step at a time.
B	Breakpoint to occur after specified number of passes past specified address.
Q	Start on specified address. Quit if STOP key or breakpoint occurs.
T	Transfers a program or part of a program from one memory area to another.
G	Golf! Rune machine language program starting at selected location.
X	Exits back to BASIC.
I	Display memory and decoded ASCII characters.
P	Pack full memory with specified byte.

What are the other unique features of the MacroTeA?

- Labels up to 10 characters in length
- 50 different symbols to choose from for each character
- 10¹⁶ different labels possible
- Create executable object code in memory or store on tape
- Text editor may be used for composing letters, manuscripts, etc.
- Text may be loaded and stored from tape or disc
- Powerful two-cassette duplicator function
- String search capability
- Macros may be nested 32 deep
- 25 Assembler pseudo-ops
- 5 Conditional assembler pseudo-ops
- 40 Error codes to pinpoint problems
- 16 Error codes related to Macros
- Warm-start button
- Enhanced monitor with 16 commands

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Auto-Run-Save, Y-t Plotter, Canary for the PET

A potpourri of programs is presented for the PET. These include two obviously useful utility programs and one program of dubious utility.

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When you have several programs on a tape, you can only select a specific one by entering LOAD together with the program name, and then you have to wait until the program has been loaded before you can enter RUN. This was one reason for me to develop the Auto-Run-Saver which allows you to save programs in a form so that they run automatically after the load. The second reason was, that the Auto-Run-Saver can also be used for nearly perfect program protection. If the

stop-key is disabled and other possibilities of program interruption are avoided, your program cannot be stopped and therefore can not be changed nor can it be listed. Auto-Run-Saver is written for 8K PETs with the old ROMs.

Using the Program

Auto-Run-Saver mainly consists of machine code which is combined with a short BASIC loader that gives

the instructions. After running the machine code is located in the last page of the 8K memory. You load the program that you want to save and place an empty tape into the cassette unit. Instead of SAVE you now enter SYS7636 and your program is saved with the auto-run feature.

Program Description

The trick of Auto-Run-Saver is, that it writes a header on the tape

AUTO-RUN-SAVER

```
5 POKE134,250:POKE135,30:CLR
10 FORI=7936TO8131:READN:POKEI,N:NEXT
20 INPUT"PROGRAM NAME ";A$
30 A=LEN(A$):IFA>16THENA=16
40 FORI=1TOA:POKE8057+I,ASC(MID$(A$,I,1))
50 NEXT
60 PRINT:PRINT"1. LOAD THE PROGRAM "A$
70 PRINT"2. PLACE A BLANK TAPE INTO THE CASSETTE UNIT
80 PRINT"3. ENTER SYS7636
90 PRINT"4. FOR FURTHER RECORDS REPEAT FROM STEP 2
500 DATA165,124,141,140, 31,165,125,141,145, 31,169, 1,133,241,169,122,133
505 DATA249,169, 31,133,250,169, 75,133,238,169, 13,133,247,169, 2,133,248
510 DATA169, 22,133,229,169, 2,133,230, 32,103,246, 32,113,248,169, 1, 32
515 DATA237,245,169,111,133,247,169, 31,133,248,169,122,133,229,169, 31,133
520 DATA230, 32, 13,247, 32, 96, 31,169, 0,133,247,169, 4,133,248,165,124
525 DATA133,229,165,125,133,230, 76, 13,247, 0, 0,169,112,141, 5, 2,173
530 DATA 5, 2, 16,251, 96, 0, 0, 0, 0, 8, 0,147, 83,217, 54, 53, 54
535 DATA 13,147, 0, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32, 32
540 DATA 32,32, 0,169,169,141,125, 2,169, 5,141,126, 2,169, 0,141,123
545 DATA 2,169, 4,141,124, 2,162, 8,189,190, 2,157, 12, 2,202,208,247
550 DATA162, 8,169, 32,157,255,127,202, 16,250,142, 16,232, 76,195,243, 4
555 DATA 0,147, 82,213, 13, 0, 0, 0, 0
READY.
```

which later advises PET to load directly into its keyboard buffer (dec. 525 to 536). In our case a SYS656 together with a carriage return is entered, leading to a small machine code routine which is a part of the program name. This routine enters RUN, Ret. into the keyboard buffer, puts the correct load addresses into the according places of the cassette buffer, disables the stop-key and finally jumps to the load-routine located in the ROM at F3C3. The disassembly (listing 2) may serve to understand the whole process more in detail.

The program mainly consists of two parts. The first one from 1F00 to 1F79 does the SAVE. The second one from 1F8B to 1FBF is saved as a part of the program name and performs the LOAD and RUN of the BASIC program.

First (1F00 to 1F09) the LOAD routine is updated with the actual "End of BASIC pointer". Then all necessary pointers are set to write a header on tape. The name for the header is 75 characters long (hex. 4B) starting at 1F7A. The start address in the header is set to 020D and the end address is 0216.

After having written the header, the pointers are prepared to write a pseudo program on tape, which starts at 1F6F and ends at 1F79. This "program" will make PET assume that 8 Keys were pressed during the loading: CLR, S, y, 6, 5, CR, CLR. The subroutine 1F60 is a waiting loop in order to provide a gap between the pseudo program and the BASIC program. After writing the BASIC code on tape (1F4B to 1F5D) the "Auto-Run-Save" is complete.

When loading such a program, PET will immediately execute the SYS656, which will lead it to the code located in the disassembly listing at 1F8B. This routine prepares the pointers to load the BASIC program without header, it stores CLR, R, u, CR into the keyboard buffer and it disables the STOP-key during the loading by storing FF into E810

Protecting a Program

The Auto-Run-Saver disables the stop-key only during the loading. Therefore your BASIC program must contain the line

```
0 POKE 537, 136
```

in order to disable the stop-key during the run. Further on all the INPUT

AUTO RUN SAVER DISASSEMBLY

C*	PC	SR	AC	XR	YR	SP	NV*	BD	IZC
.	70ED	20	53	41	56	FE	00	100000	
*									
.	1F00	A5	7C				LDA		\$7C
.	1F02	8D	8C	1F			STA		\$1F8C
.	1F05	A5	7D				LDA		\$7D
.	1F07	8D	91	1F			STA		\$1F91
.	1F0A	A9	01				LDA		=\$01
.	1F0C	85	F1				STA		\$F1
.	1F0E	A9	7A				LDA		=\$7A
.	1F10	85	F9				STA		\$F9
.	1F12	A9	1F				LDA		=\$1F
.	1F14	85	FA				STA		\$FA
.	1F16	A9	4B				LDA		=\$4B
.	1F18	85	EE				STA		\$EE
.	1F1A	A9	0D				LDA		=\$0D
.	1F1C	85	F7				STA		\$F7
.	1F1E	A9	02				LDA		=\$02
.	1F20	85	F8				STA		\$F8
.	1F22	A9	16				LDA		=\$16
.	1F24	85	E5				STA		\$E5
.	1F26	A9	02				LDA		=\$02
.	1F28	85	E6				STA		\$E6
.	1F2A	20	67	F6			JSR		\$F667
.	1F2D	20	71	F8			JSR		\$F871
.	1F30	A9	01				LDA		=\$01
.									
.									
.	1F32	20	ED	F5			JSR		\$F5ED
.	1F35	A9	6F				LDA		=\$6F
.	1F37	85	F7				STA		\$F7
.	1F39	A9	1F				LDA		=\$1F
.	1F3B	85	F8				STA		\$F8
.	1F3D	A9	7A				LDA		=\$7A
.	1F3F	85	E5				STA		\$E5
.	1F41	A9	1F				LDA		=\$1F
.	1F43	85	E6				STA		\$E6
.	1F45	20	0D	F7			JSR		\$F70D
.	1F48	20	60	1F			JSR		\$1F60
.	1F4B	A9	00				LDA		=\$00
.	1F4D	85	F7				STA		\$F7
.	1F4F	A9	04				LDA		=\$04
.	1F51	85	F8				STA		\$F8
.	1F53	A5	7C				LDA		\$7C
.	1F55	85	E5				STA		\$E5
.	1F57	A5	7D				LDA		\$7D
.	1F59	85	E6				STA		\$E6
.	1F5B	4C	0D	F7			JMP		\$F70D
.	1F5E	00					BRK		
.	1F5F	00					BRK		
.	1F60	A9	70				LDA		=\$70
.									
.	1F62	8D	05	02			STA		\$0205
.	1F65	AD	05	02			LDA		\$0205
.	1F68	10	FB				BPL		\$1F65
.	1F6A	60					RTS		

statements must be replaced by an appropriate subroutine using GET A\$. Of course it will still be possible to copy your program, i.e. with a second cassette recorder, but it will be quite difficult to change it in order to take out your copyright label.

Important Memory Locations:

7C, 7D End of Basic Pointer
F1 Current device
F9, FA Start of program name
EE Number of characters in name
F7, F8 Pointer to program start
E5, E6 Pointer to program end
027B, 027C Start address for load
E810 To disable stop during load, store a number higher than 9 in the low 4 bits
F5ED Writes a header
F70D Writes without header from addresses in F7, F8, E5, E6
F3C3 Loads program without header
F667 Sets buffer pointer
F871 Tests if cassette motor runs

Using the PET Printer 2022 as a Y-t Plotter

The Pet printer 2022 can easily be turned into a Y-t plotter using the following short program.

Listing

The function to be plotted must have the form $Y = F(T)$. The value of Y should be calculated in a subroutine starting at line 500. Y must be between 0 and 480.

Program Description

After opening all necessary channels the line feed distance is reduced by printing CHR\$(18) to channel 5. Then from line 10 to line 35 seven consecutive values of the function are calculated. The corresponding printing positions are stored in D %; the column in the printing position is stored in S%(I) where I contains the row position. The following loops from 40 to 100 determine the values of the characters that have to be transmitted to channel 5 in order to program the programmable character. For this purpose all values having the same printing position are combined. The positions which were combined are marked with D%(J)=99. Because it is not possible to program more

Pseudo Program	1F6B 00	BRK	
	1F6C 00	BRK	
	1F6D 00	BRK	
	1F6E 00	BRK	
	1F6F 08	PHP	
	1F70 00	BRK	
	1F71 93	???	
	1F72 53	???	
	1F73 D9 36 35	CMP	\$3536,Y
	1F76 36 0D	ROL	\$0D,X
Tape Header	1F78 93	???	
	1F79 00	BRK	
	1F7A 4E 41 4D	LSR	\$4D41
	1F7D 45 4F	EOR	\$4F
	1F7F 46 50	LSR	\$50
	1F81 52	???	
	1F82 47	???	
	1F83 52	???	
	1F84 41 4D	EOR	(\$4D,X)
	1F86 45 20	EOR	\$20
	1F88 20 20 00	JSR	\$0020
	1F8B A9 A9	LDA	=\$A9
	1F8D 8D 7D 02	STA	\$027D
	1F90 A9 05	LDA	=\$05
	1F92 8D 7E 02	STA	\$027E
	1F95 A9 00	LDA	=\$00
	1F97 8D 7B 02	STA	\$027B
	1F9A A9 04	LDA	=\$04
	1F9C 8D 7C 02	STA	\$027C
	1F9F A2 08	LDX	=\$08
	1FA1 BD BE 02	LDA	\$02BE,X
	1FA4 9D 0C 02	STA	\$020C,X
	1FA7 CA	DEX	
	1FA8 D0 F7	BNE	\$1FA1
	1FAA A2 08	LDX	=\$08
	1FAC A9 20	LDA	=\$20
	1FAE 9D FF 7F	STA	\$7FFF,X
	1FB1 CA	DEX	
	1FB2 10 FA	BPL	\$1FAE
	1FB4 8E 10 E8	STX	\$E810
	1FB7 4C C3 F3	JMP	\$F3C3
	1FBA 04	???	
	1FBB 00	BRK	
	1FBC 93	???	
	1FBD 52	???	
	1FBE D5 0D	CMP	\$0D,X

Y-T PLOTTER

```

1 OPEN1,4:OPEN5,4,5:OPEN6,4,6:PRINT#6,CHR$(18)
2 DIMA(5),D%(6),S%(6)
3 PRINT#1,CHR$(19)
5 DT=1
10 FORI=0TO6:GETA$:IFA$=""THEN20
15 PRINT#6,CHR$(24):CLOSE5:CLOSE6
16 PRINT#1:CLOSE1:END
20 GOSUB500:REM Y=F(T)
30 T=T+DT:D%(I)=Y/6:S%(I)=Y-6*D%(I)
35 NEXTI
40 FORI=0TO6:IFD%(I)>79THEN140
45 FORJ=0TO5:A(J)=0:NEXTJ
50 A(S%(I))=2+(6-I):IFI>5THEN110
70 FORJ=I+1TO6:IFD%(I)<>D%(J)THEN100
90 A(S%(J))=A(S%(J))+2+(6-J):D%(J)=99
100 NEXTJ
110 A$="":FORJ=0TO5:A$=A$+CHR$(A(J)):NEXTJ
115 PRINT#5,A$:IFD%(I)>0THENPRINT#1,TAB(D%(I));
120 PRINT#1,CHR$(254)CHR$(141);
140 NEXTI
150 PRINT#1,CHR$(29):GOTO10
200 REM *** YOUR FUNCTION ***
500 Y=100+100*SIN(T/50*PI/2)
510 RETURN
READY.

```

than one character per line, every character that has to be printed in the same line must be followed by a CHR\$(141) resulting in a carriage return without line feed. The program continues to plot the function until a key is pressed.

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CANARY

```

10 PRINT"***** SCANARY *****"
20 PRINT"*****CONNECT A SPEAKER TO CB2."
25 PRINT"***** PRESS ANY KEY TO STOP"
30 H=.5:L=51:K=136
40 N=65:POKE59467,16:M=59464:RG=59466
50 B=N*RND(1)+25:F=N*RND(1):A=F+B:D=(F/70+H)*RND(1)+H:Z=D*300*RND(1)/A
60 P=A/N*M:H:GETA$:IFA$THENPOKE59467,0:END:STOP
70 IFRND(1)<.1THENFORI=0TO2E3*RND(1):NEXT
80 POKERG,L:FORI=0TO2:IFRND(1)<HTHENPOKERG,K-L
90 IFRND(1)>PTHEN110
100 FORJ=ATOBSTEP-D:POKEM,J:NEXT:POKEM,0:NEXT:GOTO50
110 FORJ=BTOSTEPD:POKEM,J:NEXT:POKEM,0:NEXT:GOTO50
READY.

```

PET Singing Like a Bird

A few weeks ago my wife bought a canary. The bird was not accustomed to its new surrounding and therefore instead of singing, it sat in its cage silent and sad. Someone had to keep him company!

PET could do it. The following short program turns PET into a wonderfully singing canary. You only have to connect a speaker (with a small amplifier) to the user-port output CB2.

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Loading KIM-1 Tapes to AIM

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Here are the routines required to overcome the problem of loading KIM format tapes into an AIM when the base addresses need to be changed. They permit the user to specify from the keyboard the new starting address for a load, overriding the KIM generated starting address.  
~~~~~

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The Rockwell AIM-65 is an excellent system for the computer hobbyist, given its ASCII Keyboard, on-line thermal printer, easy-to-use I/O chips and timers, and 8K monitor. In addition, the AIM is KIM-1 compatible and allows cassette I/O in KIM format. This means that the abundant software that is available for the KIM-1 can be read via the AIM cassette interface. This feature is particularly interesting to those of us moving up to the AIM from a KIM-1.

In actual practice, however, differences between the memory maps of the KIM-1 and the AIM-65 make the loading of KIM tapes to the AIM more difficult. The problem is in the fact that the AIM monitor makes extensive use of Page One memory locations, while the KIM-1 does not. In particular, 80 bytes of AIM Page One, beginning at location \$0116, are used as the tape I/O buffer. So, although the KIM-1 can load programs into Page One from tape, the AIM cannot; KIM tape files which load to Page One cannot be loaded with the AIM tape load routines.

The KIM monitor has a feature which allows cassette files to be loaded with a starting address different from the load address stored with the tape file. This is done by specifying "FF" as the file ID. The file name and load address on tape

are ignored and the file is loaded with the starting address previously entered into RAM (KIM locations \$17F5 and \$17F6). Unfortunately, this feature was not included in the AIM routines that load KIM-format tapes. This problem of loading KIM-1 tapes has been noted by other authors (Burnett, 1979; Tripp, 1979), but no solutions have been presented.

The program below is a simple modification of the Rockwell AIM monitor routine to load KIM-format tapes to a new load address. Comments are included in the program, so little explanation should be required. The New Load Address is stored on Page Zero at locations \$0000 and \$0001. These could be changed, however, to any convenient location. The entry point to the program is at \$0900. The program is completely relocatable; all that is required to relocate the program is that this entry point be changed during assembly.

The assembly-language source version as prepared on the AIM Editor is shown in Figure 1, with the assembly listing and symbol table in Figure 2, and the disassembled listing and hex dump in Figure 3.

Execute the program with the program counter set to \$0900. The message "To =" will be displayed.

Enter the new load address followed by a carriage return, and then continue as for a normal tape load. Don't forget to change the tape speed (\$A408) to the appropriate value for your KIM-format tapes (\$5A or \$5B) prior to running this program.

I have found this program to be very useful in gaining access to programs which were initially dumped to tape from a KIM-1. Now I don't have to enter all my KIM programs by hand to make them available on the AIM, even if the original tape loaded into Page One.

References

- Burnett, J. An AIM-65 user's notes. MICRO, 1979, 12:5-7
Tripp, R.M. Ask the Doctor, Part V. MICRO, 1979 13:34-36

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Larry P. Gonzalez is an Assistant Professor of physiology and biophysics at the University of Illinois Medical Center. He has 12 years in the use of minicomputers for real-time data acquisition and signal analysis. During the last two years he has been developing a system using an AIM-65 in the collection and analysis of electrophysiological data.  
~~~~~

Figure 1. Source Listing: KIM Tape Load to New Address.

```

*=0000
.PAGE
; KIM TAPE LOAD TO
;     NEW ADDRESS
;
; ** BY L. P. GONZALEZ
;
.PAGE      'MEMORY
LOCATIONS'
NEWAD=$00;NEW ADDRESS
INFLG=$A412
SAVA=$A421
ADDR=$A41C
CKSUM=$A41E
.PAGE      'SUB-ROUTINE
EQUATES'
START=$E182
CKERR=$E385
RBYTE=$E3FD
STBYTE=$E413
GETID=$E425
CHEKAR=$E54B
TO=$E7A7
FNAM=$E8A2
CRLF=$E9F0
PACK=$EA84
CLRCK=$EB4D
TAISET=$EDEA
GETTAP=$EE29
.PAGE      'MAIN PROGRAM'
.SKIP
*=$0900
;
; DISPLAY "TO="
; & READ NEW ADDRESS
;
JSR TO
;
; STORE NEW ADDRESS
;
LDA ADDR
STA NEWAD
LDA ADDR+1
STA NEWAD+1
;
; SET INPUT DEVICE
; CODE FOR KIM-1 TAPE
;
LDA #$4B
STA INFLG
LDX #00
;
; GET FILENAME AND
;     TAPE UNIT

```

```

JSR FNAM
; LOAD KIM-1 TAPE
;
LOADKI JSR CLRCK
LOADK1 JSR TAISET
LOADK2 JSR GETTAP
CMP #'*
BEQ LOADK3
CMP #$16
BNE LOADK1
BEQ LOADK2
LOADK3 JSR RBYTE
STA SAVA
;
; READ BUT IGNORE
; OLD LOAD ADDRESS
;
; REPLACE WITH NEW
; LOAD ADDRESS
;
JSR CHEKAR
JSR CHEKAR
LDA NEWAD
STA ADDR
LDA NEWAD+1
STA ADDR+1
JSR GETID
CMP SAVA
BNE LOADK1
LOADK5 LDX #$02
LOADK6 JSR GETTAP
CMP #'/'
BEQ LOADK7
JSR PACK
BCC J1
JMP CKERR
J1 DEX
BNE LOADK6
JSR STBYTE
JMP LOADK5
LOADK7 JSR RBYTE
CMP CKSUM
BEQ J2
JMP CKERR
J2 JSR RBYTE
CMP CKSUM+1
BEQ J3
JMP CKERR
J3 JSR CRLF
;
; RETURN TO MONITOR
;
JMP START
.PAGE      'PROGRAM END'
.PAGE
.END

```

Figure 2. Assembly Listing and Symbol Table : KIM Tape Load to New Address

```

==0000      *=0000
-----
; KIM TAPE LOAD TO
;     NEW ADDRESS
;
; ** BY L. P. GONZALEZ
;
-----
MEMORY LOCATIONS
==0000 NEWAD=$00;NEW
      ADDRES
==0000 INFLG=$A412
==0000 SAVA=$A421
==0000 ADDR=$A41C
==0000 CKSUM=$A41E
-----
SUB-ROUTINE EQUATES
==0000 START=$E182
==0000 CKERR=$E385
==0000 RBYTE=$E3FD
==0000 STBYTE=$E413
==0000 GETID=$E425
==0000 CHEKAR=$E54B
==0000 TO=$E7A7
==0000 FNAM=$E8A2
==0000 CRLF=$E9F0
==0000 PACK=$EA84
==0000 CLRCK=$EB4D
==0000 TAISET=$EDEA
==0000 GETTAP=$EE29

```

```

-----
MAIN PROGRAM

==0000
    *=$0900
==0900
;
; DISPLAY "TO="
; & READ NEW ADDRESS
;
20A7E7 JSR TO
;
; STORE NEW ADDRESS
;
AD1CA4 LDA ADDR
8500 STA NEWAD
AD1DA4 LDA ADDR+1
8501 STA NEWAD+1
;
; SET INPUT DEVICE
; CODE FOR KIM-1 TAPE
;
A94B LDA #$4E
8D12A4 STA INFLG
==0912
A200 LDX #00
;
; GET FILENAME AND
; TAPE UNIT
;
20A2E8 JSR FNAME
;
; LOAD KIM-1 TAPE
;
==0917 LOADKI
204DEB JSR CLPCK
==091A LOADK1
20EAED JSR TAISSET
==091D LOADK2
2029EE JSR GETTAP
C92A CMP #'*
F006 BEQ LOADK3
C916 CMP #'16
D0F2 BNE LOADK1
F0F3 BEQ LOADK2
==092A LOADK3
20FDE3 JSR RBYTE
8D21A4 STA SAVA
;
; READ BUT IGNORE
; OLD LOAD ADDRESS
;
; REPLACE WITH NEW
; LOAD ADDRESS

```

```

;
2048E5 JSR CHEKAR
204BE5 JSR CHEKAR
A500 LDA NEWAD
8D1CA4 STA ADDR
==093B
A501 LDA NEWAD+1
8D1DA4 STA ADDR+1
2025E4 JSR GETID
CD21A4 CMP SAVA
D0CF BNE LOADKI
==0948 LOADK5
A202 LDX #$02
==094A LOADK6
2029EE JSR GETTAP
C92F CMP #'/'
F011 BEQ LOADK7
2084EA JSR PACK
9003 BCC J1
4C85E3 JMP CKERR
==0959 J1
CA DEX
D0EE BNE LOADK6
2013E4 JSR STBYTE
4C4809 JMP LOADK5
==0962 LOADK7
20FDE3 JSR RBYTE
CD1EA4 CMP CKSUM
F003 BEQ J2
4C85E3 JMP CKERR
==096D J2
20FDE3 JSR RBYTE
CD1FA4 CMP CKSUM+1
F003 BEQ J3
4C85E3 JMP CKERR
==0978 J3
20F0E9 JSR CRLF
;
; RETURN TO MONITOR
;
4C82E1 JMP START
-----
PROGRAM END

-----

END
ERRORS= 0000

SYMBOL TABLE
ADDR F41C
CHEKAR E54B
CKERR E385

```

```

CKSUM A41E
CLPCK EB4D
CRLF E9F0
FNAME E8A2
GETID E425
GETTAP EE29
INFLG A412
J1 0959
J2 096D
J3 0978
LOADK1 091A
LOADK2 091D
LOADK3 092A
LOADK5 0948
LOADK6 094A
LOADK7 0962
LOADKI 0917
NEWAD 0000
PACK EA84
RBYTE E3FD
SAVA A421
START E182
STBYTE E413
TAISSET EDEA
TO E7A7
NEWAD 0000
LOADKI 0917
LOADK1 091A
LOADK2 091D
LOADK3 092A
LOADK5 0948
LOADK6 094A
J1 0959
LOADK7 0962
J2 096D
J3 0978
INFLG A412
ADDR A41C
CKSUM A41E
SAVA A421
START E182
CKERR E385
RBYTE E3FD
STBYTE E413
GETID E425
CHEKAR E54B
TO E7A7
FNAME E8A2
CRLF E9F0
PACK EA84
CLPCK EB4D
TAISSET EDEA
GETTAP EE29

```


Figure 3. Disassembled Listing and Hex Dump: KIM Tape Load to New Address

<K>#0900

/49

```
0900 20 JSR E7A7
0903 AD LDA A410
0906 85 STA 00
0908 AD LDA A41D
090B 85 STA 01
090D A9 LDA #4B
090F 8D STA A412
0912 A2 LDX #00
0914 20 JSR E8A2
0917 20 JSR EB4D
091A 20 JSR EDEA
091D 20 JSR EE29
0920 C9 CMP #2A
0922 F0 BEQ 092A
0924 C9 CMP #15
0926 D0 BNE 091A
0928 F0 BEQ 091D
092A 20 JSR E3FD
092D 8D STA A421
0930 20 JSR E54B
0933 20 JSR E54B
0936 A5 LDA 00
0938 8D STA A41C
093B A5 LDA 01
```

```
093D 8D STA A41D
0940 20 JSR E425
0943 CD CMP A421
0946 D0 BNE 0917
0948 A2 LDX #02
094A 20 JSR EE29
094D C9 CMP #2F
094F F0 BEQ 0962
0951 20 JSR EA84
0954 90 BCC 0959
0956 4C JMP E385
0959 CA DEX
095A D0 BNE 094A
095C 20 JSR E413
095F 4C JMP 0948
0962 20 JSR E3FD
0965 CD CMP A41E
0968 F0 BEQ 096D
096A 4C JMP E385
096D 20 JSR E3FD
0970 CD CMP A41F
0973 F0 BEQ 0978
0975 4C JMP E385
0978 20 JSR E9F0
097B 4C JMP E182
```

```
< > 0900 20 A7 E7 AD
< > 0904 1C A4 85 00
< > 0908 AD 1D A4 85
< > 090C 01 A9 4B 8D
< > 0910 1E A4 A2 00
```

```
< > 0914 20 A2 E8 20
< > 0918 4D EB 20 EA
< > 091C ED 20 29 EE
< > 0920 C9 2A F0 06
< > 0924 C9 16 D0 F2
< > 0928 F0 F3 20 FD
< > 092C E3 8D 21 A4
< > 0930 20 4B E5 20
< > 0934 4B E5 A5 00
< > 0938 8D 1C A4 A5
< > 093C 01 8D 1D A4
< > 0940 20 25 E4 CD
< > 0944 21 A4 D0 CF
< > 0948 A2 02 20 29
< > 094C EE C9 2F F0
< > 0950 11 20 04 EA
< > 0954 90 03 4C 85
< > 0958 E3 CA D0 EE
< > 095C 20 13 E4 4C
< > 0960 4C 09 20 FD
< > 0964 E3 CD 1E A4
< > 0968 F0 03 4C 85
< > 096C E3 20 FD E3
< > 0970 CD 1F A4 F0
< > 0974 03 4C 05 E3
< > 0978 20 F0 E9 4C
< > 097C 02 E1 00 00
```

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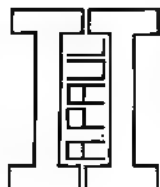
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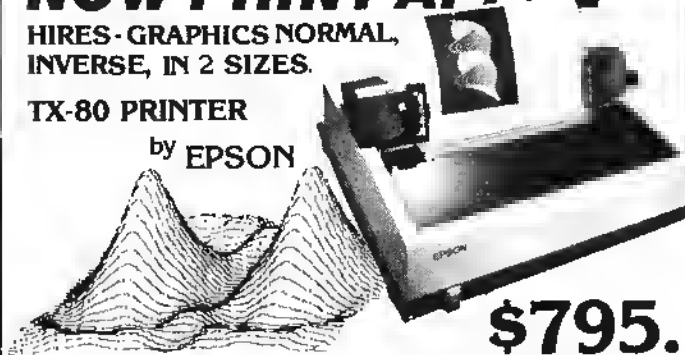
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Compact

~~~~~  
**Another member of the "Stripper" family - programs to strip REMarks from BASIC programs - this version works on the AIM and does the stripping in place. It does not require the use of disk or cassette tapes.**  
~~~~~

Steve Bresson
1302 Strawberry Ln
Hanover, MD 21076

The "Apple Stripper" Program in MICRO 23:11-12 removes the REM statements from a program using a BASIC program and a disk file. I would love to use this method, but a 4K AIM-65 with a tape recorder would make for a long wait. The assembly program given here was programmed slightly before "Apple Stripper", and does the compaction in place.

Compact is a program to strip out blanks and REMs from a BASIC program. This is done to save space and increase the operating speed of a large or heavily documented program.

The program is run as follows:

- 1) Load in COMPACT. I put it in high memory for the 4K AIM.
- 2) Initialize BASIC. Make sure it does not overlap COMPACT.
- 3) Escape back to the Monitor.
- 4) Run COMPACT. On the AIM, just hit <FL>.

COMPACT operates by scanning through the BASIC program looking for quotes, blanks, and REM tokens. Blanks are stripped out as they are encountered. All text between quotes is ignored. A REM forces one of two things to be done. If the character counter is zero, then the REM is at the beginning of the line and the whole line is removed. A non-zero character count indicates

the REM is placed after text, so only the remainder of the line is removed. In all cases, pointers to the locations to be removed are passed to subroutine PACK, which does the actual deletion.

PACK performs the nontrivial task of closing up the BASIC program to overwrite the unwanted string. Then the BASIC pointers are changed so that BASIC still knows where the program is located.

The final operation in PACK is a jump to \$B329. This is a subroutine in the BASIC ROM which relinks the line pointers of the program. The NBLP (New BASIC Line Pointer) subroutine expects the "standard" BASIC line format of:

```
0 1 2 3 4.....n
:lo, hi:lo, hi:basic text.....:00:
LINE   LINE   END OF
PTR    NUMBER  LINE
```

It scans through each line, first checking the line Pointer high byte for a \$00, which would indicate the end of the program. If the line pointer is not zero, the line is scanned until a \$00 is found. That address plus one is the beginning of the next line and is placed in the line pointer. The NBLP pointer is moved to the beginning of the new line and the process starts over.

For those of you who do not have the AIM, an assembly language

NBLP is also listed. Assuming your BASIC stores its programs in the same format as the AIM, only a couple of things need be known to make this program run on your machine:

- 1) The address of the Beginning of BASIC (BOB) pointer.
- 2) The address of the Top of BASIC (TOB) pointer.
- 3) A couple of 2 byte locations in page 0 for temporary use as pointers.

By plugging these values into the listing you should not (hopefully) have any problems.

Program Listing

- 1) Assembler output of "COMPACT".
- 2) Start up of BASIC so that top of memory is not affected.
- 3) Crossed out PGM, skip this.
- 4) BASIC PGM to be compacted.
- 5) Test run to show program output.
- 6) List of BASIC Pointers at \$0075 — top of BASIC before compaction.
- 7) <[> <F1> KEY RUN COMPACT
- 8) RUN of Compacted PGM.
- 9) List of Compacted PGM.
- 10) New top of BASIC PTR = \$0261, OLD = \$02 LAC!
- 11) Change of M.L. PGM to use 'NBLP1' instead of BASIC


```

:PACK V10. 2. 25. 80. 5L
B
:DEL:HOLDS DEL AREA
START ADDR
:SAV: HOLDS END OF D
EL AREA+1 ADDR
==0F62 PACK
A5A8 LDA DEL+1
856D STA GT0+1
A5A7 LDA DEL
38 SEC
E56A SBC SAV
18 CLC
6575 ADC TOB
A675 LDX TOB
866A STX SAV
==0F72
8575 STA TOB
856C STA GT0
A576 LDA TOB+1
89FF ADC #FF
8576 STA TOB+1
E5A8 SBC DEL+1
A8 TAX
38 SEC
A5A7 LDA DEL
==0F82
E575 SBC TOB
A8 TAX
B003 BCS PK1
E8 INX
C66D DEC GT0+1
==0F8A PK1
18 CLC
656A ADC SAV
9003 BCC PK2
C66B DEC SAV+1
18 CLC
==0F92 PK2
816A LDA (SAV),Y
815C STA (GT0),Y
18 INY
D0F9 BNE PK2
E66B INC SAV+1
E66D INC GT0+1
CA DEX
D0F2 BNE PK2
:JMP NEW BASIC LINE
PTR SUBR
4C29B3 JMP NBLP
-----
==0FA3
:REPLACEMENT FOR THE
:RIM BASIC ROM PGM
==0FA3 NBLP1

```

```

A473 LDY BOB
A574 LDA BOB+1
84FC STY TMP
85FD STA TMP+1
18 CLC
==0FAC NBLP2
A001 LDY #1
:END OF PGM?
B1FC LDA (TMP),Y
F01D BEQ NBLP4
A004 LDY #4
:NO! LOOK FOR #00
==0FB4 NBLP3
C8 INY
B1FC LDA (TMP),Y
D0FB BNE NBLP3
C8 INY
:FOUND IT!
98 TYA
:CALC ADDRESS
65FC ADC TMP
A8 TAX
A000 LDY #0
91FC STA (TMP),Y
:CHANGE BASIC PTR
A5FD LDA TMP+1
==0FC4
6900 ADC #0
C8 INY
91FC STA (TMP),Y
:CHANGE BEGINNING OF
:LINE PTR
86FC STX TMP
85FD STA TMP+1
90DD BCC NBLP2
==0FCF NBLP4
60 RTS
-----

```

```

==0FD0 THEEND
END
ERRORS= 0000

```

```

(2) <3>
MEMORY SIZE? 3750
WIDTH?
3220 B-TES FREE
:IN 65 BASIC V1.1
<N>=7B A6 0E 1A 00

```

```

(4) :LT
10 REM TEST OF COMP
ACT OF 4/2/80

```

```

20 PRINT "THIS IS A
TEST "
30 A = 5 : B = 7
40 C = 11 : REM ABC
D
50 A = 6 : PRINT "
DONE! " : REM XXXXX
60 GOTO 70 : REM YY
YY
70 END

```

(5)

```

RUN
THIS IS A TEST
DONE!

```

(6)

```

Top of BASIC -
<N>=0075 02 02 01 02
< > 0079 01 02 A6 0E

```

(7)

```

<C>
JUST RAN THE TEST

```

(8)

```

RUN
THIS IS A TEST
DONE!

```

(9)

```

LIST
20 PRINT"THIS IS A
TEST "
30 A=5:B=7
40 C=11
50 A=6:PRINT" DONE!
"
60 GOT070
70 END
Top of BASIC

```

```

(10) <N>=0075 76 02 76 02
< > 0079 76 02 A6 0E

```

(11)

JMP NBLP1

```

<N>=FA0 4C A3 0F A4
TEST WITH NBLP1 LINK
ED TO ASM PGM

```

(12)

```

RUN
THIS IS A TEST
DONE!

```

```

15T
10 REM TEST2 !!!
20 PRINT"THIS IS A
TEST "

```

```

30 A=5:B=7
40 C=11
45 D = 55:REM ASDDF
50 A=6:PRINT" DONE!
"
60 GOTO70
65 D = C : PRINT"HE
LP!" : REM XXXY
70 END

```

```

RUN
THIS IS A TEST
DONE!
DONE!

```

```

(13)
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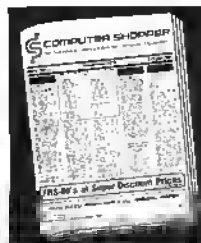
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A C1P and H14 System, Part 2

A previous article provided the information required to interface an H14 printer to an OSI C1P computer. This article provides the software necessary to drive the printer.

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In a previous part of this series of articles I promised some software to further the use of the C1P and a printer. In my system the printer is a Heath H14. Yours may be of another manufacture. In any case, this software should support your printer if you have used the modifications to your C1P and have interfaced your printer. This program will help you with your task of writing all forms of business and personal letters.

The program in listing 2 gives the user of the C1P and the H14 system the needed software to allow the format of business letters. This program will allow the user to develop letters, which are in the modified block form. The program allows the user to store the heading; the complimentary close; and the identification as a permanent part of the program. That is, your street address in this heading, the closing, compliment such as "Sincerely yours" and your name as the identification. The inside address; the salutation; and the body of the letter are entered on query from the computer.

To begin, the program at line 30 through 65 is used to develop the heading; the inside address, and the salutation of the letter being written. In the example program, lines 30 and 35 contain the heading. This heading is stored in Strings and is a permanent part of the program. You will have to enter your own address in these two lines. This data

will be printed out when you call for a printout of your letter. At lines 37 and 40, you will be asked for the month which will be stored in A\$(4). Line 40 gets the date and year. The date and year is stored in the numerical variables E and Y. Lines 45 through 55 are used to collect the information for the inside address and the salutation. This data is stored in Strings. These Strings are: A\$(9), A\$(5), A\$(6), A\$(7), and A\$(8). These Strings are not a permanent part of the program. That is, each time the program is run these strings will require new data and must be input by the user. These are all input statements. Lines 60 and 65 form the complimentary close and the identification for the letter being composed. This data is permanent and will have to be entered when you load the program for the first time. To continue, the program at lines 70 through 210 is where the body of the letter is entered by the user. This data or letter text is stored in String arrays. Up to 256 lines of text can be entered and stored in memory arrays. B\$(1) holds each line of text. That is, as you type in each line of text, that line will be placed in B\$(1).

The variable I contains the line number for the text data which goes into B\$. If I equaled 1 then B\$(1) would become position B\$(1) etc. The length of each line in the text for the body of the letter is set to a maximum of characters. If you type more characters in the line than the

set length the computer responds with overwidth and the line of text is deleted. You will have to type in the line again. The statement at line 140 sets down a pointer to indicate where a line will end. This pointer should not be exceeded. At line 180, line 180 is the INPUT statement for the text input if all the letter text has been completed. Line 210 causes a RETURN through the body routine if the letter text has not been completed. When the body of the letter has been completed, and the user types the escape key(&) the program branches to line 5000. The routine at lines 5000 through 6000 is used to insure that the letter is placed correctly on the page. This subroutine checks for the number of lines that the user has entered into memory. The body of the text is read and the number of text lines are stored in the variable L, the variable L is checked against a constant of 32. The value of variable L is subtracted from 32 and stored in the X variable. The X variable is then divided by 3.

The final value of X is used to space the letter properly on the page. That is, the paper will be advanced the amount that is equal to $\frac{1}{3} X$. For example, if you only had 6 lines of text in the body of your letter, this value would be subtracted from 32. The X variable then would be 26. After dividing the X Variable by 3, X would be approximately 8. This value will advance the paper 8 spaces before the heading and date are printed

out. The routine from 5000 to 5070 obtains the final value for the X variable. The routine from 5080 through 5095 generates the line feeds for the paper advance. This is accomplished with a PRINT statement in a FOR-NEXT loop. At line 6000 a RETURN is executed and the program returns to line 1000.

Beginning at line 1080 the main body of the letter text is retrieved from the array and printed out to the screen and the printer. This is done with the FOR-NEXT loop at lines 1080 and 2000. At line 2007 a gosub is executed. The subroutine at 4000 is used to produce the correct amount of spaces between the body of the letter and the complimentary close. This subroutine uses the value in the X variable in the same manner as the routine at line 5000. At this point, FI should explain the statement at line 4000. The statement at line 4000 uses the keyword LOAD followed by the keyword POKE, 515,0. The statement LOAD: POKE 515,0 actually returns the C1P to the fast CRT routine. The LOAD command expects an INPUT from either the cassette recorder or the keyboard, but immediately we turn off the LOAD command by POKEing the flag at 515 with zero. This disables the LOAD command and returns the program to line 4030.

On return from the subroutine at 4070 the complimentary close and identification are printed in the letter. At line 2033 we again return the program from a SAVE mode to the regular program execution with the statement LOAD: POKE 515,0. From this point the program jumps to line 3000 where the user will be asked if more copies of the letter are desired. The "Letter Writer" program has some features that are hidden from the quick observer. The main feature is that the text editing feature of the C1P's ROM BASIC can be used to edit the text when entering the lines in your letter. This is done with the use of Control C and Control P. If a letter in your text was incorrectly inserted, you may change the letter by typing a control O. This will delete the last letter that you entered. Also, if a complete word was misspelled simply count the letters in the word and type Control O the correct number of times that were in the word. Now type in the correct word or correct spelling

OK
LIST

```

1 REM LETTER WRITER BY W. L. TAYLOR
2 REM AUGUST 15, 1979
3 PRINT"      LETTER WRITER  "
4 PRINT:PRINT:PRINT
10 PRINT" DATE YEAR AND LETTER TEXT MUST BE
                                ENTERED"

30 A$(2)="246 Fiona Road"
35 A$(3)="Leavittsburg, Ohio"
37 INPUT"MONTH";A$(4)
40 INPUT" TODAY'S DATE---AND YEAR";E,Y
45 INPUT"COMPANY";A$(5)
47 INPUT"STREET ADDRESS";A$(6)
49 INPUT" CITY,STATE ZIP";A$(7)
50 INPUT" PERSON";A$(8)
55 INPUT" GREETING";A$(9)
60 A$(10)="Sincerely,"
65 A$(11)="Mr. William L. Taylor"
70 D=64
80 I=256
90 DIM B$(I)
100 PRINT
110 FOR I=1 TO 256
120 PRINT I
140 POKE 54181+(D-50),94
180 INPUT B$(I)
190 IF LEN(B$(I))>D THEN PRINT"OVERWIDTH";I=I-1
200 IF B$(I)=">" THEN 5000
210 NEXT I
250 GOTO 5000
1000 SAVE
1005 PRINT TAB(50);A$(2)
1010 PRINT TAB(50);A$(3)
1015 PRINT TAB(50);A$(4);E,Y
1020 PRINT:PRINT:PRINT:PRINT
1030 PRINTA$(5)
1035 PRINTA$(6)
1040 PRINTA$(7)
1050 PRINT:PRINT
1055 PRINTA$(8)
1060 PRINT:PRINT
1070 PRINTA$(9)
1075 PRINT:PRINT
1080 FOR J=1 TO I-1
1090 PRINTB$(J)
2000 NEXT J
2007 GOSUB 4000
2010 PRINT
2020 PRINT TAB(50);A$(10)
2025 PRINT:PRINT:PRINT
2030 PRINT TAB(50);A$(11)
2035 LOAD: POKE 515,0

```

for the word that was misspelled. If a complete line in the letter were needed, you simply type a Control P. This will delete the entire line of text. This program also allows the use of the C1P's lower case letter feature. That is, when you wish to enter lower case letters you need only to release the Shift-Lock key to shift into lower case letters mode. This will allow you to use both capital and lower case letters in your text.

In part one of this series I gave the reader the necessary hardware information to allow the C1P to function in a 300 Baud RS232C mode. The use of the C1P and a Heath H14 Printer was described along with the modifications to the printer to be used with the Challenger C1P. Some software was given. This article has been an extension of that article. I hope that this series has been of interest and will be a tool to help you further improve your computer system and software.

μ

```

2040 GOTO 3000
3000 PRINT" DO YOU WANT ANOTHER COPY.
      TYPE YES OR NO"
3010 INPUT Q$
3020 IF Q$="YES" THEN GOTO 5000
3030 END
4000 LOAD:POKE 515,0
4030 FOR A=1 TO X
4040 SAVE
4050 PRINT
4060 NEXT A
4070 GOTO 2010
5000 L=0
5010 FOR J=1 TO I-1
5020 L=L+1
5030 PRINTB$(J)
5040 NEXT J
5050 IF L=32 THEN 1000
5060 IF L<32 THEN X=32-L
5070 X=X/3
5080 FOR A=1 TO X
5085 SAVE
5090 PRINT
5095 NEXT A
6000 GOTO 1000

```

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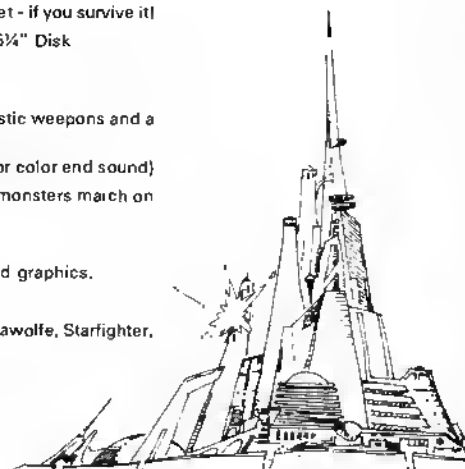
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XREFER

~~~~~  
**XREFER stands for 'cross reference'. The BASIC program presented here permits the output of an assembler to be sorted and cross referenced. The cross reference listing can be a very valuable tool when debugging machine language programs.**  
~~~~~

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When programming in assembly language the quality and features of the assembler being used can make a great deal of difference in how well the project proceeds. That's one reason professional programming departments are willing to spend a lot of money to buy and support large and powerful cross assemblers for their programming efforts. Most computer hobbyists though can only afford to use software that runs on their own machines. These assemblers for the most part, offer only the most basic features.

I bought MICRO-ADE(1) as an alternative to programming my MOS Technology KIM-1 microcomputer in machine language. MICRO-ADE is a large step up from machine language. It is also a large step down from the IBM-370 assembler to which I am accustomed. I soon found that most of the more advanced functions (expression evaluation, macros, relocatability, and conditional assembly) I could easily get along without. One thing I sorely missed though was the sorted cross-reference table. A cross-reference table is invaluable when debugging or modifying a program, especially when the program was written by someone else.

I implemented MICRO-ADE as my system assembler by modifying it to read source files from, and write object files to my disk system. It ac-

cepts unnumbered source files created by my system editor and generates its own line numbers. It creates object files that are loaded by a special load program. It has everything I need except a cross-reference table. To remedy this situation I wrote XREFER. XREFER is a program in MICROSOFT BASIC(2). It reads the same source files as MICRO-ADE, and produces a sorted label table giving the line number of the definition of each label and the line number of each reference to each label.

Implementation

The main task of a cross-reference program is data storage. It must be able to handle a variable number of labels, each with a variable number of references. The most obvious way to allocate the required storage in BASIC is to dimension 3 arrays, a one dimensional array for labels, a one dimensional array for definitions, and a two dimensional array for references. This will work, but one quickly runs into a problem. Most labels are referenced between 1 and 5 times in an assembly language program, but in most programs there will be one or more labels that are referenced 10, 20 or more times. To dimension the reference array large enough to hold the maximum number of references would use a large amount of memory. This would also waste a large amount of memory since most

of the memory allocated for labels with fewer references would be unused. Allowing for a large number of references for each label also reduces the number of labels that can be handled in available memory. To dimension fewer than the maximum would result in an incomplete cross-reference. This problem can be overcome by dividing the reference storage into two 2 dimensional arrays. The first has an element for each entry in the label array and each element has room for a few references (5 or 6). The second is used as an array to overflow arrays. It has only a few elements but each element has room for a lot of references (20 or 30). The reference array for a label is filled, the next available overflow array is chained to it, and all subsequent references to that label are stored in that overflow array. This allows more efficient use of available memory.

Larger source files will no doubt exceed available memory no matter how efficiently it is used. No matter how much memory is bought there will be a program that needs more. Is there no way to make the program handle an infinite amount of data? Yes there is! In this case the range of labels accepted into the table in any one reading of the file is limited. Then the file is read multiple times. Each reading will extract a different part of the entire table. For instance there may be only enough memory to store one-third of the labels in a

large assembly language program. XREFER can be run 3 times on the same source file. Labels beginning with A-G are cross-referenced in the first pass, H-S in the second, and T-Z in the third. The resulting 3 tables can then be joined to form a complete cross-referenced with enough passes of the file (Actually XREFER is limited to 32767 lines by the integer variables used to store the line numbers). Setting a range on the labels also allows operands other than normal labels to be cross-referenced. Immediate operands, absolute hex addresses, and data assignments can also be extracted if desired.

While the file is being read for the cross-reference table there is some other useful data that may be gathered. A table of opcodes and a count of their occurrences would also be interesting. For the MICRO-ADE defaults several addressing modes and optimizes others. Some address modes are implicit to the opcode. This means that those address modes cannot accurately be counted. Nevertheless the address modes that are counted correctly (IX, IY, IM) are worth the small space required.

XREFER is logically divided into four sections, initialization, data collection, sort and print, and subroutines. Listing 1 is the XREFER program listing. The initialization section prompts the user for options, allocates storage and opens the input file. The arrays for data storage are dimensioned according to specifications input by the user. This allows the user to tailor memory usage to the source file being processed. When the cross-reference table option is selected XREFER prompts the user for the size of the label table, the number of references per label, the number of overflow arrays and the length of the overflow arrays. Determining the numbers to enter for each of the above is a matter of trial and error. The data collection subroutines have built-in overflow detection to aid the user. Messages are printed when any of the arrays overflow. There are also overflow counters to record the number of times data is lost. These will give the user an idea of how much to increase the size of the arrays. When a program has too many labels for the available

storage, the number of labels accepted can be limited by decreasing the range of labels accepted. It may take several runs to determine the correct parameters for a large program. XREFER also allows the user to select whether or not any of the three tables is built on a given run. If a table is not selected its storage is not allocated. The last thing requested is the filename. After the file is opened the assembler language source statements are read one at a time and the three parts (label, opcode and operand) are extracted. The comment field, if present, is ignored. The label is inserted into the label table and its definition line number saved. The opcode is stored and counted and the address mode extracted. The comment field, if present, is ignored. The label is inserted into the label table and its definition line number saved. The opcode is stored and counted and the address mode extracted and counted if present. The operand is then used to add a reference to the reference array (A new entry is made into the label table if necessary). The line numbers are generated as the lines are read in. When the end of the input file is reached, the sort and print section of XREFER is entered.

The Shell-Metzner sorting technique is used. Shell-Metzner requires a few more statements than the ubiquitous bubble sort but it executes in about a tenth of the time for a table of 200 labels. Any sorting algorithm requires switching of the data elements it is sorting. The labels in the label table in XREFER are connected logically to a data structure of definitions, references and overflow arrays. Switching labels would destroy this logical structure. Labels would end up with the wrong references. Moving the actual data around would require a lot of time and memory. Instead a special array (SRT%) of pointers is sorted. Before the sort, SRT% is initialized to 1, 2, 3,...etc. must be dimensioned at least as large as the number of elements being sorted. The sort comparison is made between elements indexed by SRT%. Then the pointers in SRT% are switched if necessary instead of the actual data. After sorting is finished, the SRT% array is used to index the data for printing. The labels are printed in alphabetical order with

their definitions and references. The same technique is used for both the opcode table and the label table. The address mode table is a static table and is not sorted. After all the requested tables are printed XREFER gives the user the opportunity to repeat the printing section to get another copy of the tables. XREFER can also be restarted at line 7200 to print the tables.

Operation

Listing 2 is a sample run of XREFER. XREFER prompts the user for each parameter. In this run the arrays were purposely dimensioned too small to show the error messages generated when they overflow and what to change to correct problem. Note that answering 'N' to the 'SYMBOL TABLE (Y or N)?' will cause all other questions about the symbol table to be omitted. Also answering 0 to 'NUMBER OF OVERFLOW ARRAYS?' will effectively delete overflow processing from the program.

I use XREFER to document all of my larger assembly language programs. I use the cross-reference often during testing. With it I can quickly locate every reference to a data area and every place a subroutine is called. XREFER takes longer to generate the cross-reference listing than MICRO-ADE takes to assemble the same source file but the resulting cross-reference table is well worth the time.

(1) MICRO-ADE is an assembler for the 6502 microprocessor. It is sold by MICROWARE Ltd. 27 Firstbrook Rd. Toronto, Ontario, Canada M4E 2L2. It does not use the standard MOS Technology syntax.

(2) XREFER is written in 9 digit MICROSOFT BASIC. It is distributed by MICRO-Z company Box 2426 Rolling Hills California 90724. It has been extended to add disk I/O capability.

LISTING 1: XREFER implemented in MICROSOFT BASIC for the 6502 microprocessor. XREFER uses standard BASIC syntax except for the disk I/O related commands. The disk I/O commands are implemented as standard BASIC commands with the postfix character #. DIM # allocates a buffer for the file. GET

opens the file for input. END # sets the statement number to be executed when the end of the file is reached. INPUT # reads line of the file. Variables followed by a # are integer variables. Integer variables are used wherever possible to save storage. Integer arrays require only 2 bytes of storage per entry while floating point arrays require 5 bytes per entry.

Listing 2: A run of XREFER generating all three tables for a small assembly language program.

```

1151
1000 REM      XREFER
1100 REM
1200 REM
1300 REM INITIALIZATION
1400 REM
1500 DIM# 1
1600 TRUE=-1:FALSE=0
1700 PRINT "ENTER DP1DWB"
1800 INPUT "SYMBOL TABLE(Y OR N)":ANS$
1900 IF ANS$<>"Y" THEN 3000
2000 INPUT "NUMBER OF SYMBOLS TO DIMENSION":NUM
2100 INPUT "NUMBER OF REFERENCES TO DIMENSION":XN
2200 INPUT "ENTER NUMBER OF OVERFLOW ARRAYS":OV
2300 IF OV<=0 THEN 2400
2400 INPUT "ENTER LENGTH OF OVERFLOW ARRAYS":OL
2500 DIM ROVFL%(OV,OL)
2600 INPUT "SYMBOL RANGE 10":HLS
2700 INPUT "SYMBOL RANGE HI":HHS
2800 LT%=TRUE
2900 DIM LABEL$(NUM), DIFF$(NUM), HEF$(NUM,XN)
3000 INPUT "OPCODE TABLE(Y OR N)":ANS$
3100 IF ANS$<>"Y" THEN 3400
3200 DIM CODE$(60), CCNT$(60)
3300 CT%=TRUE
3400 INPUT "ADDRESS MODE TABLE(Y OR N)":ANS$
3500 IF ANS$<>"Y" THEN 4000
3600 DIM MODE$(9), MCNT$(9)
3700 MT%=TRUE
3800 MODE$(7)="Z":MODE$(8)="A":MODE$(9)="NONE"
3900 FOR I=0 TO 6:MODE$(I)=MID$("ATXZXZYIMIXIY",I*2+1,2):NEXT I
4000 INPUT "ENTER FILENAME":FIS
4100 IF NOT CT% AND NOT LT% THEN 4500
4200 A=60
4300 IF NUM>A THEN A=NUM
4400 DIM SHT%(A)
4500 LINNO%=1
4600 GET# 1 FIS:FND# 1 GOTO 7200
4700 REM
4800 REM      DATA COLLECTION
4900 REM
5000 INPUT# 1 FIS$
5100 IF LINE$="" OR LEFT$(LINE$,3)="" THEN 4700
5200 REM GET LABEL, OPCODE AND OPERAND
5300 GOSUB 10100
5400 REM STORE LABEL
5500 IF NOT IT% THEN 5900
5600 TS=LEFT$(LABEL$,1):IF TS=HLS AND TS<HHS THEN GOSUB 17000
5700 REM STORE REFERENCE
5800 TS=MID$(OP$,1,1):IF TS=HLS AND TS<HHS THEN GOSUB 20500
5900 IF CODE$="" THEN 6700
6000 MODE$=MID$(CODE$,4,2)
6100 IF NOT CT% THEN 6400
6200 REM COUNT OPCODE
6300 GOSUB 23200
6400 IF NOT IT% THEN 6700
6500 REM COUNT MODE
6600 GOSUB 24000
6700 LINNO%=LINNO%+1
6800 GOTO 5000
6900 REM
7000 REM      SORT AND PRINT DATA
7100 REM
7200 IF NOT IT% THEN 11700
7300 GOSUB 24000
7400 REM
7500 REM SORT XREF TABLE
7600 REM
7700 FOR T=1 TO NUM:IF LABEL$(T)<>"" THEN NEXT
7800 M%=INT(I-1):K%=N%
7900 M%=M%/2
8000 IF M%=0 THEN 9500
8100 K%=K%-M%
8200 J%=1
8300 T%=J%
8400 L%=T%+M%
8500 IF LABEL$(SRT%(I%))<=LABEL$(SRT%(L%)) THEN 8900
8600 TMP%=SRT%(L%):SRT%(L%)=SRT%(I%):SRT%(I%)=TMP%
8700 T%=I%-M%
8800 IF T%>=1 THEN 8400
8900 J%=J%+1
9000 IF J%>K% THEN 7900
9100 GOTO 8300
9200 REM
9300 REM PRINT XREF TABLE
9400 REM
9500 I=1
9600 PRINT:PRINT "SYMBOL","DEFINED","REFERENCES"
9700 S=SRT%(1):IF LABEL$(S)="" THEN 11700
9800 PRINT LABEL$(S),DIFF$(S),
9900 FOR J=0 TO XN
10000 IF REF$(S,J)=0 THEN 11200
10100 IF POS(X)>65 THEN PRINT:PRINT "", "",
10200 IF REF$(S,J)>0 THEN 11000
10300 L=-REF$(S,J)-1
10400 FOR K=0 TO OL
10500 IF ROVFL%(L,K)=0 THEN 11200
10600 IF POS(X)>65 THEN PRINT:PRINT "", "",
10700 PRINT ROVFL%(L,K);
10800 NEXT
10900 GOTO 11200
11000 PRINT REF$(S,J);
11100 NEXT J
11200 PRINT
11300 I=I+1:IF I<=NUM THEN 9700
11400 REM
11500 REM SORT OPCODE TABLE
11600 REM
11700 IF NOT CT% THEN 15100
11800 GOSUB 24000
11900 FOR I=1 TO 60:IF CODE$(I)<>"" THEN NEXT
12000 M%=INT(I-1):N%=I%
12100 M%=M%/2
12200 IF M%=0 THEN 13700
12300 K%=I%-M%
12400 J%=1
12500 T%=J%
12600 L%=T%+M%
12700 IF CODE$(SHT%(I%))<=CODE$(SHT%(L%)) THEN 13100
12800 TMP%=SRT%(L%):SRT%(L%)=SHT%(I%):SHT%(I%)=TMP%
12900 T%=I%-M%
13000 IF T%>=1 THEN 12600
13100 J%=J%+1
13200 IF J%>K% THEN 12100
13300 GOTO 12500
13400 REM
13500 REM      PRINT OPCODE TABLE
13600 REM
13700 PRINT:PRINT "OPCODE USAGE TABLE"
13800 J=1:FOR I=1 TO 60
13900 FOR K=1 TO 4
14000 TS=CODE$(SRT%(J))
14100 IF TS="" THEN 15100
14200 T=LEN(TS):IF T<3 THEN TS=TS+" ":GOTO 14200
14300 PRINT " ":TS;CCNT$(SRT%(J)),
14400 J=J+1
14500 NEXT K
14600 PRINT
14700 NEXT I
14800 REM
14900 REM      PRINT ADDRESS MODE TABLE
15000 REM
15100 IF NOT MT% THEN 16200
15200 PRINT:PRINT:PRINT "ADDRESS MODE OCCURENCES"
15300 MODE$(7)="Z":MODE$(8)="A"
15400 J=0
15500 FOR K=1 TO 3
15600 IF J>9 THEN 16200
15700 PRINT " ":MODE$(J);MCNT$(J),
15800 J=J+1
15900 NEXT
16000 PRINT
16100 GOTO 15500
16200 PRINT:PRINT:PRINT:INPUT "REPEAT":ANS$
16300 IF ANS$="Y" THEN 7200
16400 END
16500 REM
16600 REM SUBROUTINES START HERE * * *
16700 REM
16800 REM STORE LABEL
16900 REM
17000 FOR I=1 TO NUM
17100 IF LABEL$(I)=LABEL$ THEN 17600
17200 IF LABEL$(I)="" THEN 17500
17300 NEXT
17400 O1=O1+1:PRINT "TOO MANY LABELS":RETURN
17500 LABEL$(I)=LABEL$
17600 OFF$(I)=LINNO%
17700 RETURN
17800 REM
17900 REM PARSE FOR LABEL OPCODE AND OPERAND
18000 REM
18100 CODE$="":OHS=""

```

```

18200 LABEL$="":IF LEFT$(LINE$,1) <> " " THEN 18500
18300 K=2
18400 DO: 19100
18500 FOR K=1 TO 6
18600 IF MID$(LINE$,K,1) = " " THEN 19000
18700 LABEL$=LABEL$+MID$(LINE$,K,1)
18800 NEXT
18900 RETURN
19000 K=K+1
19100 FOR J=K TO K+5
19200 TS=MID$(LINE$,J,1):IF TS="" THEN 20100
19300 IE TS=" " THEN 19600
19400 CODE$=CODE$+TS
19500 NEXT
19600 J=J+1
19700 FOR K=J TO J+6
19800 TS=MID$(LINE$,K,1):IF TS="" OR IS=" " THEN 20100
19900 OPS=OPS+TS
20000 NEXT
20100 RETURN
20200 REM
20300 REM COUNT REFERENCE
20400 REM
20500 FOR I=1 TO NUM
20600 IE LABEL$(I)=OPS THEN 21100
20700 IE LABEL$(I)="" THEN 21000
20800 NEXT
20900 O1=O1+1:PRINT"TOO MANY LABELS":RETURN
21000 LABEL$(I)=OPS
21100 FOR J=0 TO XH
21200 IE REE$(1,J)=0 THEN REE$(1,J)=LINNO$:RETURN
21300 NEXT
21400 IE OV<1 THEN PRINT"NO OVERFLOW ARRAYS": 4=O4+1:RETURN
21500 J=J+1
21600 IE REF$(I,J)<0 THEN 22400
21700 FOR K=0 TO OV:IE ROVEL$(K,0)=0 THEN 22000
21800 NEXT:O2=O2+1:PRINT"NOT ENOUGH OVERFLOW ARRAYS":RETURN
21900 REM SET UP CHAIN
22000 ROVEL$(K,0)=REE$(1,J)
22100 REE$(I,J)=K-1
22200 ROVEL$(K,1)=LINNO$:RETURN
22300 REM ADD 10 OVERFLOW
22400 K=-REF$(I,J)-1
22500 FOR L=1 TO OL:IE ROVEL$(K,L)=0 THEN 22700
22600 NEXT:O3=O3+1:PRINT"OVERFLOW ARRAYS NOT LONG ENOUGH":RETURN
22700 ROVEL$(K,L)=LINNO$:RETURN
22800 RETURN
22900 REM
23000 REM STORE AND COUNT OPCODE
23100 REM
23200 CODE$=LEFT$(CODE$,3):FOR I=1 TO 59
23300 IE CODE$(I)=CODE$ GOTO 23700
23400 IF CODE$(I)="" THEN 23600
23500 NEXT
23600 CODE$(I)=CODE$
23700 CCN1$(I)=CCN1$(I)+1
23800 RETURN
23900 REM
24000 REM COUNT ADDRESS CODE
24100 REM
24200 FOR I=0 TO 0
24300 IE CODE$(I)=CODE$ THEN 24500
24400 NEXT
24500 CCN1$(I)=CCN1$(I)+1
24600 RETURN
24700 REM INIT SORT POINTER MATRIX
24800 FOR I=1 TO A:SR1$(I)=I:NEXT:RETURN

```

JK

```

RUN
ENTER OPTIONS
SYMBOL TABLE(Y OR N)? Y
NUMBER OF SYMBOLS TO DIMENSION? 100
NUMBER OF REFERENCES TO DIMENSION? 4
ENTER NUMBER OF OVERFLOW ARRAYS? 4
ENTER LENGTH OF OVERFLOW ARRAYS? 25
SYMBOL RANGE LO? A
SYMBOL RANGE HI? Z
OPCODE TABLE(Y OR N)? Y
ADDRESS MODE TABLE(Y OR N)? Y
ENTER FILENAME? 2/LOADQ
TOO MANY LABELS
TOO MANY LABELS
TOO MANY LABELS
TOO MANY LABELS
TOO MANY LABELS
TOO MANY LABELS

```

```

H
BREAK IN 17100
OK
RUN
ENTER OPTIONS
SYMBOL TABLE(Y OR N)? Y
NUMBER OF SYMBOLS TO DIMENSION? 110
NUMBER OF REFERENCES TO DIMENSION? 4
ENTER NUMBER OF OVERFLOW ARRAYS? 4
ENTER LENGTH OF OVERFLOW ARRAYS? 25
SYMBOL RANGE LO? A
SYMBOL RANGE HI? Z
OPCODE TABLE(Y OR N)? Y
ADDRESS MODE TABLE(Y OR N)? Y
ENTER FILENAME? 2/LOADQ
OVERFLOW ARRAYS NOT LONG ENOUGH
OVERFLOW ARRAYS NOT LONG ENOUGH
OVERFLOW ARRAYS NOT LONG ENOUGH
@
BREAK IN 8800
OK
RUN
ENTER OPTIONS
SYMBOL TABLE(Y OR N)? Y
NUMBER OF SYMBOLS TO DIMENSION? 110
NUMBER OF REFERENCES TO DIMENSION? 4
ENTER NUMBER OF OVERFLOW ARRAYS? 4
ENTER LENGTH OF OVERFLOW ARRAYS? 35
SYMBOL RANGE LO? A
SYMBOL RANGE HI? Z
OPCODE TABLE(Y OR N)? Y
ADDRESS MODE TABLE(Y OR N)? Y
ENTER FILENAME? 2/LOADQ

```

SYMBOL	DEFINED	REFERENCES
ADTMPH	32	125
ADTMPL	31	123
ALLOCKX	92	
ALTH	30	293
ALTL	29	290
ARMBUF	381	
BACKX	80	336
BADADD	218	203 212
BADFIL	177	107 130 134 150
BADGET	276	
BADRET	180	128 143 160
BCSBAD	149	113
BINDEX	86	246 259 296 334
BUFADD	82	288
BUFF	422	114 116
BUFFER	54	
BUFPTR	41	386
BUFPYL	40	383
BUFPTR	39	255
BYTBYE	216	199 210
CHRSBV	43	208 213
CRLF	67	141
CTKP	26	
CURCHR	34	326

DIRPTR	33	343	346	350	353	360	363		
DPTR	28								
DPTL	27								
DRIVE	78	285	328						
DRVSAV	35	330							
DSDR	15	287							
DSEC	17	284	317						
DSTK	16	281	314						
ENDOFF	98	135							
ENDOFI	94								
EOF	215	201							
ERRET	219	225	227						
FCBPTH	38	111							
FCBPTL	37	109							
FCOPTR	36	244	247	250	260	270	273	280	283
		286	289	292	298	301	304	309	312
		315	318	329	335	337	339	341	345
		348	355	350	365	368	371	382	385
		388							
FILEPR	95								
FILTP	83	299							
FIRST	142	133							
FLSC	19	311							
FLTK	18	308							
FNAME	77								
FTYP	23	300							
FWOC	60								
GETADD	63	121							
GETOYT	198	142	148						
GETCHR	242	127	209						
GETORV	64	327							
GETEOF	275	245							
GETRET	277	295							
GETSEC	268								
INOUT	87								
INVADD	93								
INVCMD	91								
INVOFF	100								
IEN	20	303							
LENGTH	81	249	302						
LIMITX	85	364							
LOADER	103								
LODLUP	167	173	175						
LRET	145	122							
MESGB	394	185							
MOVEFB	307								
NEXTX	79	269	279						
NOAD	232	229							
NOCHR	263	253							
NOEND	147	144							
NOEOF	279	271	274						
NXTCHR	254	251							
NXTOKN	65	105	120						
OBJFCB	421	110	115	117	119	131	422		
OBJPTH	48	137	147	150	152	161	174		
OBJPTL	47	139	151	153	155	163	172		
OBJPTR	46	171							
OFFSEH	50	126	157						

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OUTSP	68	165			
PACKX	224	202	211		
PDUN	191	187			
PMSG	185	136	160	178	190
PRTBYT	69	138	140	162	164
PSTH	25				
PSTL	24				
READSC	252	248			
REORG	135	169			
RSEX	58	294			
SAVHEX	45				
SAVOBJ	44				
SEARCH	61	331			
STARTX	84	354			
TGTH	22				
TGTL	21				
THEEND	418				
WSEX	59				
WTDIR	62				
XSAVE	42				
ZERO	97	170	297	333	

OPCODE USAGE TABLE

* 31	= 24	ADC 3	AND 1
ASL 4	BCS 12	BEQ 7	BMI 2
BNE 10	BPL 2	CLC 8	CMP 11
DEY 4	INC 2	INX 1	INY 14
JMP 1	JSH 23	LDA 38	LDX 4
LDY 20	ORA 1	PHA 3	PLA 3
RTS 7	SEC 1	STA 41	TAY 2
TYA 1			

ADDRESS MODE OCCURENCES

AY 0	AX 1	ZX 0
ZY 0	IM 38	IX 0
IY 41	Z 0	A 4
NDNE 197		

REPEAT? N

DK

Classified Ads

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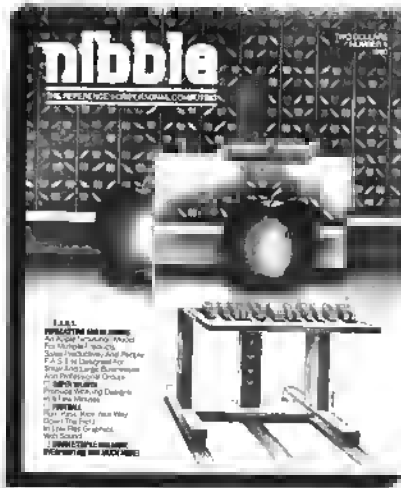
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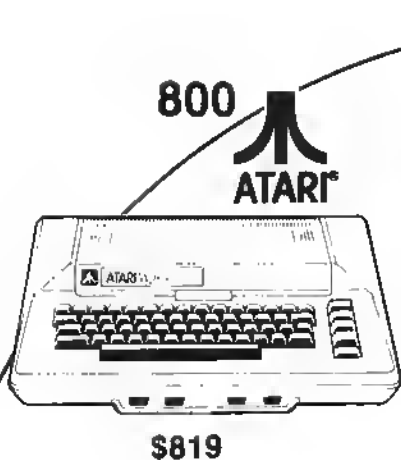
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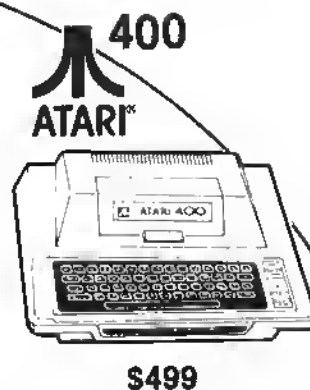
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OHIO SCIENTIFIC'S

In this issue of MICRO, the Ohio Scientific Small Systems Journal presents a system overview of OS-65U Level I and a very informative article on expanding OS-65D mini-floppy BASIC.

OS-65U Level I allows the setup of a simple, cost-effective, multi-terminal network using a single disk based computer in concert with several personal computers. The system is extremely well suited for the educational environment and demonstrates some of the 'hidden power' of the personal computer.

The article on expanding mini-floppy BASIC demonstrates a clever method which allows up to 26 new reserved words to be added to BASIC.

As always, reader comments on article content are always welcome. Please submit suggestions, or any other contributions, to:

Ohio Scientific, Inc.
Small Systems Journal
1333 South Chillicothe Rd.
Aurora, Ohio 44202

OS 65U LEVEL I — UPLOADING AND DOWNLOADING ON A MULTI — TERMINAL SYSTEM

Even small systems can take advantage of the storage capabilities of any one of a group of Challenger computers (C-1P's, C-4P's, and/or C-8P's). This feature permits networking of computers, sharing a central file system, and even information interchange between terminals.

The OS-65U operating system can service and support several satellite "personal computers" from a central host computer. Each satellite computer can be a C-1P, a C-4P, or a C-8P, and for the remainder of the article will also be referred to as a "terminal". The terminal can stand alone with no reduction in its capabilities or it can use the resources of the host computer to extend its capabilities. Hardware modifications, readily performed by your OSI dealer, will be required. The satellite computers/terminals, when initially ordered can be specified with an "Option-11" for the C-XP systems. The Option-11 allows up/down load as well as retaining normal cassette I/O. The host system requires installation of a multiple I/O port board, designated as CA-10L8 for 8 ports. In general, any disk based system can serve as the host computer. It is convenient to choose the one with the greatest disk storage capability. In order to present the maximum increase in storage to each terminal.

Each satellite computer, whether the C-1P, C-4P or C-8P, retains all the features of the stand-alone computer. These features include 8K MICROSOFT (R) BASIC in ROM, the ability to SAVE and LOAD cassette programs, and access to all the computer's memory and accessories. For example, the home control features of a C-4P MF could be enjoyed while using the computer for computer aided instruction.

Programs and data files can be downloaded from or uploaded to the host computer in a Level I Multi-Terminal System. This feature permits applications such as Computer Based Education, with the ability to access the lesson or course on the host computer while retaining the powerful BASIC programming capability at

each computer terminal. Sharing data and exchanging programs while retaining isolation of each independent, giving its user the full resources of the computer at that station. The CPU (Central Processor Unit) of each station is totally available for the user, since it does not have to timeshare its resources with the host. The benefits of fast response, high data transfer rates, and low cost are not compromised.

USE:

To each terminal on the Multi-Terminal System, the host computer will function as a high speed serial port which can be addressed by a filename. Each terminal uses its serial port at a clock rate set by jumpers in the host computer (with data rates up to 19.2 Kilobaud!)

To use the Multi-Terminal System, BOOT up the host system and RUN the program MULTI. All current OS-65U Systems contain this program on disk file. Now, BOOT up your terminal(s), with the Cassette/Level 1 switch positioned at LEVEL 1. If you do nothing else, your terminal is a stand alone computer. Let's take advantage of this status to enter a very short program.

```
NEW
10 PRINT "TEST MESSAGE":END
When you type
SAVE
```

the facilities of the host computer will be made available assuming the terminal switch in the LEVEL 1 position. Since we wish to save this program we type

```
REM S FILNAM
where FILNAM is the file name of an available disk file
on the host computer. The host computer expects the
next entry to be
LIST
which effects the transfer of the program to the host
computer's file, FILNAM. To discontinue transfer
capability to the host computer, type, for example, the
entry
```

```
LOAD <CARRIAGE RETURN>
then
<SPACE>
```

The symbol <SPACE> denotes a blank space. Similarly, the symbol <CARRIAGE RETURN> denotes a carriage return. These symbols will be used when there is some chance of ambiguity of notation. Otherwise, <CARRIAGE RETURN> is assumed to terminate a keyboard entry. If we now enter

```
NEW
we will clear the workspace on our terminal. We can
check this by typing
```

```
LIST
To download our program from the host computer's
disk file, we again get the services of the host computer
by entering the command
```

```
SAVE
and then
REM L FILNAM
then
LOAD
```

The file, FILNAM, will be transferred from the host computer's disk and displayed during transfer to the terminal, as we can observe by typing

```
<SPACE>LIST
The short program should be listed on our terminal
screen. If we had wished to list on the host computer's
printer, the command would have been
```

Small Systems Journal

SAVE
REM P
LIST
LOAD
<SPACE>

Note: LOAD, <CARRIAGE RETURN>, <SPACE> terminate link.

Provisions are made in the program MULTI to disconnect a terminal which has requested services of the host computer (by typing SAVE) but has not finished its request by entering

REM L FILNAM

After approximately 13 seconds of inactivity, the program MULTI will assume that no further activity is expected from the calling terminal, and the host computer will again scan the terminals for input.

APPLICATIONS:

Storing copies of programs, such as educational materials, and uploading and downloading the programs to each terminal makes these programs available within an educational network. (These same benefits of uploading and downloading could prove equally useful in a small business environment.)

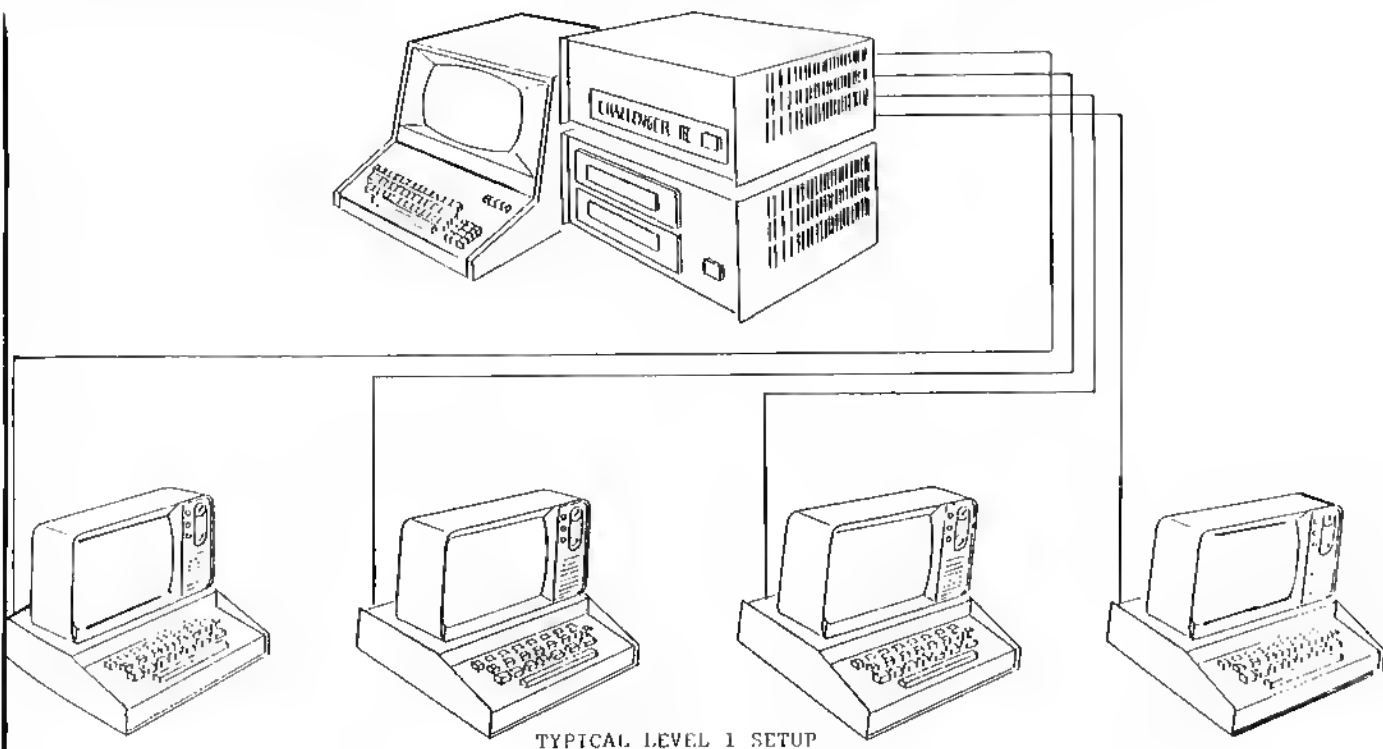
In a typical application in education, a C-8F DF might be used as a host computer while four satellite computers, say C-1P's, serve as individual student stations. Although each satellite costs about half the cost of a dumb terminal, it possesses more abilities than many nominally intelligent terminals. The program MULTI

would permit each terminal to request downloading of the current lesson. For simplicity, the instructor may wish to modify MULTI to permit automatic downloading to ease lesson startup for less experienced students. Each student could then save his/her lesson onto cassette for future use after the lesson is completed.

In a typical lesson, the student may have need of the computing power of BASIC. A null response to a lesson question will return the student to BASIC. After completing his/her calculations in BASIC the student could return to the educational program with the results of the calculation in hand.

In a similar manner, student responses can be automatically stored for instructor review by writing the educational program with storage of the answers in an answer array. By SAVEing the student's program in a student file on the host computer, individual answers can be reviewed and student progress assessed by the instructor. These possible features are all within the flexibility of BASIC programming. These features allow the power of a sophisticated computer aided instruction system to be built on the resources of your OS 65U host system and the simple BASIC programming of MULTI.

Since the satellite stations can be run with high baud rates and downloaded programs can themselves request downloading, then it is possible to use the extensive graphics support which is available from OSI within educational program with the results of the calculation in hand.



TYPICAL LEVEL 1 SETUP

OHIO SCIENTIFIC'S

These ideas are intended to point out the power of what appears to be a relatively simple program.

Summary

Several methods are available to obtain source materials, including cassette or keyboard entry, and disk entry from the terminal or host computer. The methods provide a variety of ways to transfer materials between systems.

Since MULTI is written in BASIC, it provides the flexibility to support your specialized Level I needs, providing specialized uploading and downloading, logging, and branching to special servicing programs by the methods suggested.

Flexibility characterizes the LEVEL I System. It provides the benefit of sharing common programs and using central files while retaining the dedicated computer use at each terminal. It provides a case of "having your cake and eating it too!"

Adding New Reserved Words to BASIC

In this article, we describe a method that can be used by the assembly language programmer to add new reserved words to Ohio Scientific Microsoft BASIC on mini-floppy disk based computers using OS-65D B3.x. This method involves minimal changes to the BASIC interpreter. These changes can be accomplished by seven POKES. Using this method, one can add up to 26 new words, each of which is a single letter followed by an asterisk (*). To simplify the assembly language code, we require that each new reserved word contain no embedded blanks. Each new word can be executed either in the immediate mode or from a running program.

Ohio Scientific Microsoft BASIC is implemented by an interpreter. This means that the BASIC program is stored in memory in ASCII, just as it was entered from the keyboard (with exceptions which we will describe later). When a BASIC program is running, the interpreter (a machine language program) examines each line, executes the appropriate code and then advances to the next line. To do this, the interpreter maintains a pointer, which we will call TXTPTR, that points to the area in memory which contains the BASIC statement currently being interpreted by the interpreter. Note: A pointer is a word in memory that contains an address.

TXTPTR is a 16-bit word at \$C7 and \$C8 on page 0. The low byte of the address is at \$C7 and the highbyte is at \$C8. Note: \$ is 'shorthand' meaning hexadecimal. When the interpreter begins to scan a line of BASIC code, TXTPTR points to the first non-blank character on the line. After interpreting the line, TXTPTR must be incremented until it points to the byte containing the terminator for the line, either \$00 or \$3A (carriage return or colon, respectively).

As we said previously, a BASIC program is stored in ASCII as it was entered from the keyboard. One exception is that a carriage return is stored as \$00. The other exception is that all reserved words (PRINT, NEXT, GOSUB, etc.) and all operators (*, +, AND, SIN, etc.) are "tokenized", that is stored in one byte in a special code which is not standard ASCII. The token for an asterisk is \$A5.

When a line of a BASIC program is stored in memory, the first byte after the line number is one of the tokens. The one exception to this is a LET statement which omits the reserved word LET. That is, LET X=0 or X=0. Hence, if the first group of characters on a line is a word which is not a BASIC reserved word, the interpreter branches to the code for LET. This is where we insert a JSR to our new code which will look for new words and execute appropriate code if one is found.

The code for LET begins at decimal address 2470 (OS-65D V3.x on mini-floppy). The first three lines of this code are, in machine language, \$20, \$2E, \$0F, \$85, \$96, \$84, \$97. We replace these seven bytes with hex 20, 00, 50, EA, EA, EA, EA. This calls a machine language subroutine at \$5000.

Address \$5000 is where we will put out new code. This address can be changed to any other available address by the user. The changes in these eight bytes can be accomplished by:

```
POKE 2470
POKE 2471,0
POKE 2472,80
POKE 2473,234
POKE 2473,234
POKE 2475,234
POKE 2476,234
```

An appropriate place for these POKES is in BEXEC*. They can also be put at the beginning of a BASIC program which contains a new reserved word. In our sample programs we put our new code at \$5000. After the new code is assembled, it can be stored on disk with a DISK! "SA..." instruction and then brought into memory by a DISK! "CA...". Thus, on the disk which contained our sample programs, we added to BEXEC* the seven POKES above and a DISK! "CA..." instruction.

In Listing 1 we introduce one new word, C*, which initiates a machine language screen clear. The program is, in outline, the following:

- Step 1) Check the second character on the line to see if it is the token for an asterisk. Then see if the first character is a C. If either of these fail, branch to BACK where we executed the machine code that was deleted from LET, then RTS back to LET.
- Step II) If the line is C* then execute the screen clear code.
- Step III) Add 2 to TXTPTR.
- Step IV) At this point we want to return to the point from which LET was called, so we can proceed to the next line. Execution of an RTS, however, will take us back to LET and a syntax error will result. Thus, we first execute PLA:PLA to remove one address from the stack and then RTS.

In the next example we insert two reserved words: C* as above and S* which will act as a switch to enable or disable the scrolling of

Small Systems Journal

the screen after a PRINT. The effect of S* is the same as:

```
X = PEEK(9770)
IF X=64 THEN POKE 9770,0
IF X=0 THEN POKE 9770,64
```

Listing 1

```
10 00C7= TXTPTR=%C7
20 00A5= TOKEN=%A5
30
40 5000 ; x=%5000
50
60 5000 A001 NEWORD LOY #1
70 5002 E1C7 LDA (TXTPTR),Y get 2nd chr of the line
80 5004 C9A5 CMP #TOKEN
90 5006 002E BNE BACK if not star taken then RTS
100 5008 88 DEY
110 5009 E1C7 LDA (TXTPTR),Y get 1st chr of the line
120 500B C9A5 CMP #C
130 500D 0027 BNE BACK if not "C" then back to LET
140
150 ;
160 ;code for new reserved word begins here
170
180 500F A920 NEWCODE LDA #32 ASCII for a blank
190 5011 A000 LOY #0 ready for indexed STA
200 5013 A208 LDX #8 no. of pages on screen
210 5015 990000 PUTIT STA #0000,Y
220 5018 C8 INY
230 5019 00FA BNE PUTIT
240 501E EE1750 INC PUTIT+2 if Y rolls over then change
250 501E CA DEX page
260 501F 00F4 BNE PUTIT
270 5021 A900 LDA #000 restore for
280 5023 8D1750 STA PUTIT+2 next call
290
300 ;
310 ;need to update TXTPTR before return to BASIC
320
330 5026 ASC7 UPDATE LDA TXTPTR
340 5028 18 CLC
350 5029 6902 ADC #2
360 502B 85C7 STA TXTPTR
370 502D A5E8 LDA TXTPTR+1
380 502F 6908 ADC #0 add the carry if it's there
390 5031 85C8 STA TXTPTR+1
400 ;now TXTPTR points to the end-of-line marker
410 ;
420 ;there are two return addresses on the stack
430 ;pull off the top one so that we return to the
440 ;place where LET was called, instead of to LET
450
460 5033 68 PLA
470 5034 68 PLA
480 5035 60 RTS
490
500 ;
510 ;BACK is the machine code that was deleted from LET
520 ;and replaced by JSR #5000
530
540 5036 28 BACK .BYTE $20,$2E,$0F,$85,$96,$84,$97
540 5037 2E
540 5038 0F
540 5039 85
540 503A 96
540 503B 84
540 503C 97
550 503D 60 RTS
560 .END
```

Listing 2 is outlined as follows:

Step I) Compare the second character on the line and the token for an asterisk. If it isn't, then branch to BACK as in the first program.

Step II) If it is an asterisk, then enter a loop which compares the first character on the line and the entries of a table called, NAMTBL, which contains all the legal characters. In the sample program the table has three entries, 'C', 'S', 0. The zero marks the end of the table. If this last entry is reached, then we branch to BACK and a syntax error will eventually result. This table can be expanded to up to 26 letters in any order.

Step III) If a match is found, then we use the index register from the compare loop to get an address from a table of addresses (actually a double table; one for low byte, one for high byte), put the address into a JMP instruction and then execute the JMP. The effect is the same as an Indirect JMP.

Step IV) After executing the code which is appropriate to the word, exit through UPDATE, as before.

Following the steps outlined in example two, 24 more reserved words may be easily added.

Listing 2

```
10 00C7= TXTPTR=%C7
20 00A5= TOKEN=%A5
30
40 5000 ; x=%5000
50
60 5000 A001 NEWORD LOY #1
70 5002 E1C7 LDA (TXTPTR),Y get 2nd chr of the line
80 5004 C9A5 CMP #TOKEN
90 5006 0054 BNE BACK if not star taken then RTS
100 5008 88 DEY
110 5009 A208 LDX #0
120 500B 8D2450 LOOP LDA NAMTBL,X
130 500E F04C BEQ BACK if at end of table
140 5010 E8 INX
150 5011 D1C7 CMP (TXTPTR),Y
160 5013 00F4 BNE LOOP keep trying if no match
170
180 5015 8D2650 FOUND LDA LDAOR-1,X get address, low byte
190 5018 8D2250 STA JMPLO
200 501B 8D2850 LDA HIAOR-1,X get address, hi byte
210 501E 8D2350 STA JMPHI
220
230 5022= JMPLO=+1
240 5023= JMPHI=+2
250
260 5021 4CFFFF JMP $FFFF by the time this is executed
270 ; the address is changed
280
290 5024 43 NAMTBL .BYTE 'C','S',0
290 5025 53
290 5026 00
300
310 5027 2E LOADR .BYTE $2E,$44
310 5028 44
320
330 5029 50 HIAOR .BYTE $50,$50
330 502A 50
340
350 ;
360 ;code for new reserved word begins here
370
380 502E A920 C.CODE LDA #32 ASCII for blank
390 502D A000 LOY #0 ready for indexed STA
400 502F A208 LDX #8 no. of pages on screen
410 5031 990000 PUTIT STA #0000,Y
420 5034 C8 INY
430 5035 00FA BNE PUTIT
440 5037 EE3350 INC PUTIT+2 if Y rolls over then change
450 503A CA DEX page
460 503B 00F4 BNE PUTIT
470 503D A900 LDA #000 restore for
480 503F 8D3350 STA PUTIT+2 next call
490 5042 0008 BNE UPDATE always branches
500
510 ;
520 5044 AD2A26 S.CDOF LDA 9770
530 5047 4940 EOR #540
540 5049 8D2A26 STA 9770
550
560 ;
570 ;need to update TXTPTR before return to BASIC
580
590 504C ASC7 UPDATE LDA TXTPTR
590 504E 18 CLC
600 504F 6907 ADC #2
610 5053 A5C8 STA TXTPTR+1
620 5055 6908 ADC #0 add the carry if it's there
630 5057 85C8 STA TXTPTR+1
640
650 ;now TXTPTR points to the end-of-line marker
660 ;
670 ;there are two return addresses on the stack
680 ;pull off the top one so that we return to the
690 ;place where LET was called, instead of to LET
700
710 5059 68 PLA
720 505A 68 PLA
730 505B 60 RTS
740
750 ;
760 ;BACK is the machine code that was deleted from LET
770 ;and replaced by JSR #5000
780
790 505C 28 BACK .BYTE $20,$2E,$0F,$85,$96,$84,$97
790 505D 2E
790 505E 0F
790 505F 85
790 5060 96
790 5061 84
790 5062 97
800 5063 60 RTS
810 .END
```

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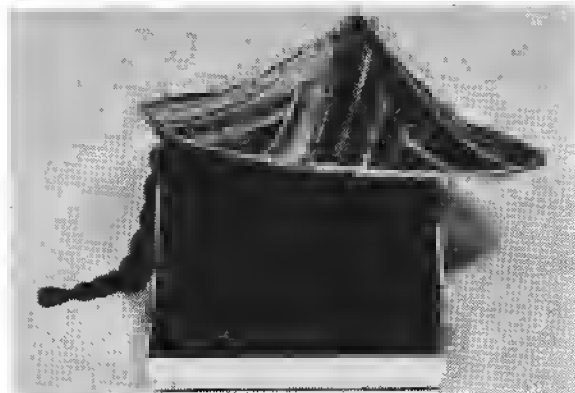
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MICRO CLUB CIRCUIT

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Meets on the third Saturday of each month. Various sub-groups meet during the month. Over 170 members in this fairly new group. They can be contacted at:

N.E.O. Apple Corps
P.O.Box 39364
Cleveland, OH 44139

"Our newsletter was incorrectly listed. If anyone requests information on APPLE BITS they may use the above address. Our primary objectives are to inform area Apple owners of new points of interest and to introduce the community to personal computers through monthly demonstrations."

Wollongong Computer Club

Meets every fortnight and includes a number of small users groups. Presently they are TRS-80, OSI, Pet, Apple, Z80, 8085 and Sorcerer oriented. Address any correspondence to:

Paul Janson
14 Hayward Street
Kahooka, NSW 2530
Australia

"We also have members with no machine just a common interest."

Appleseed

Meets every other Wednesday at 7:30 p.m. at local computer stores and other locations depending on the program and facilities required. Publish a newsletter. Dr. Terry Mikiten is President. Address inquiries to:

John Ghidoni, Treas.
12801 Huebner Road
San Antonio, TX 78230

"We aim to provide a forum for information exchange, to provide education in the techniques and application of the apple computer by members and outside sources and to provide an interface with other similar clubs throughout the country, specifically including the International Apple Core."

The G.R.A.P.E. Group for Religious Apple Programming Exchange

A new international group, and as such they do not have membership meetings. They express their purpose, interest, and activities to be together in a common desire to share their faith and gifts in APPLE programming. They publish a monthly newsletter, The Grape Vine. GRAPE's full policy statement will be

sent to all persons expressing an interest by writing to:

G.R.A.P.E.
Stephen M. Lawson
P.O.Box 283
Port Orchard, WA
98366

Permten Besin Amateur Computer Group

Meets on the second Tuesday evening and the second Saturday at different locations. John Rabenaldt is President over 15 members. Several special interest groups. Write to:

John Rabenaldt
Ector County School District
Box 3912
Odessa, TX 79760

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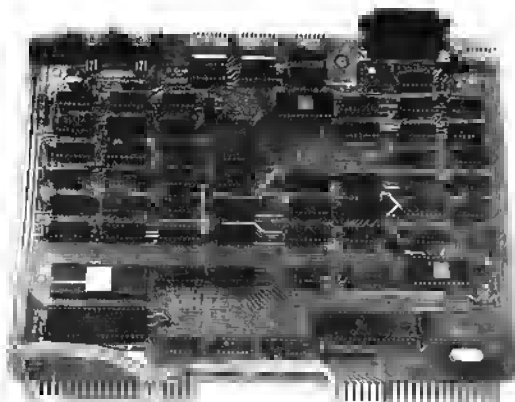
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PET VET

Loren Wright
P.O. Box 6502
Chelmsford, MA 01824

As the newly appointed "PET expert" on the MICRO staff, I'd like to introduce myself. I have experienced many of the same joys and frustrations you have, from the early lack of documentation to the arrival of the new ROM's. My experience with the PET includes applications to teaching, interfacing peripherals and instruments, hardware modification, character set substitution, and extensive programming in BASIC and machine language.

I will increase my knowledge and experience by constantly reviewing the literature, keeping track of new developments in software, hardware, and firmware, and by strengthening my communication with Commodore. Using the MICRO Lab's PET system, I'll be testing programs and products for the PET, and increasing my own "hands on" experience. As part of MICRO's commitment to the PET, I will become truly an expert. We are aware that many of the PET-oriented magazines are no longer in existence, and it is MICRO's intent to increase our PET coverage to help fill that void.

Meanwhile, I'll be working to expand and improve MICRO's PET coverage. This means printing

more PET articles, keeping you informed of new developments, and answering your questions in a "PET VET" column. In the August MICRO we published James Strasma's review of the Programmer's Toolkit, and you can expect that other new PET/CBM hardware, software, and firmware, will be reviewed in future issues.

If you've been wondering where to send that PET/CBM article, this is the place. Send for a MICRO writer's guide if you're having trouble getting started. Also, send in your questions for the PET VET column. They can be directed toward any aspect of PET or CBM use.

Finally, remember that there is someone here at MICRO who knows and cares about your PET.

Microbes and Updates

Les Cain found that in "OSI BASIC in ROM, What's Where" (23:65) the five missing keywords can be found by changing line 120 to:

```
120 FOR C = 41062 TO 41089 STEP 3
```

The program will then include:

```
AC69    AND
AC66    OR
BAEF    >
ABD8    =
AC96    <
```

Wendall A. Malpass of Wake Forest, NC, sent the following variations in for some AIM-65 programs:

from 19:38 "Clear"

Location 0305 - LDA 035F
should be: LDA 035F, Y

Location 035F - 43 4C D2
should be: 43 4C 52

Reference to loaded character is at 034E, not 0340.

from 19:39 "Mover"

Location 02C A - 4E 45 D7
should be: 43 4C 57

and from 12:7 "Write to Memory"

If not printing, last line cannot be read. I changed location 0058 to: JSR E993

then, location 000F to: BEQ 005B
0027 to: BEQ 005B

location 005E - "RTS" is preferred over "BRK".

Jerry Tenenbaum of Toronto, Canada, sent in the following information regarding the article "Plotting a Revolution" in 16:5:

On page 8, byte 1E6B should be E2 (not EC)

Loren Wright, MICRO PET Specialist, found the following microbe in "Plotting with Special Character Graphics" 24:11:

On page 13, Figure 1, the second row of symbols was upside down. The whole figure should appear in this order:



Figure 1

Marvin DeJong of Point Lookout, MO found that:

The Morse Code Send/Receive program described in 21:19 will not work if a Mother Plus is attached to the AIM 65. The motherboard's IC U2 prevents any device on the AIM 65 from pulling the IRQ pin low. One solution to get the Send/Receive program to work is to disconnect pin 1 of U2, another solution would be to disconnect the motherboard for this program.

The Mother Plus has recently been redesigned and no longer presents this problem.

A Versatile HI-RES Function Plotter for the APPLE II

One of the obvious uses for APPLE HI-RES capability is to plot various mathematical functions. The program presented here is very general purpose and permits the user to simply plot any expression as a function of angle from 1 to 360 degrees. A modification is included which will permit the program to be used on an ATARI as well.

David P. Allan
19 Damon Rd.
Scituate, MA 02066

A few years ago when scientific calculators first made their appearance I was enchanted by the ease with which calculations using transcendental functions could be accomplished. This prompted me to dust off the old trigonometry book and delve into some basics through which I had once passed somewhat painfully. Maybe pain isn't the word. Probably boredom and drudgery would be better words. Log and function tables are probably the only documents with less magnetism than the Little Rock telephone book.

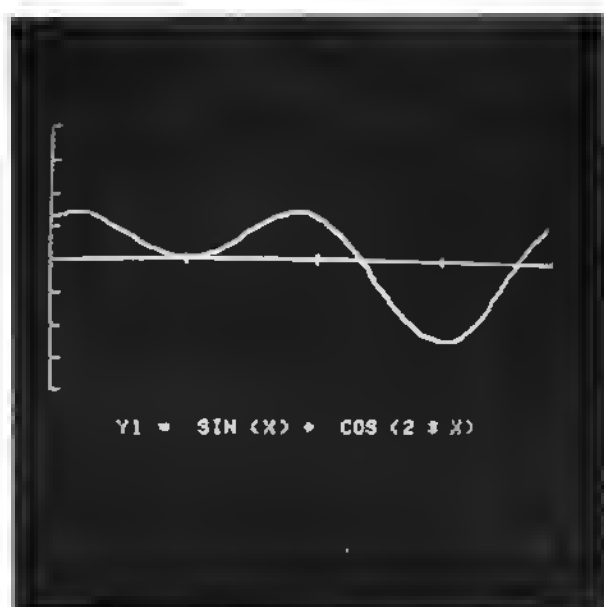
I expect that many a budding mathematics curiosity has atrophied over the dryness of log tables.

With the power and freedom of this nifty calculator at hand I suddenly found myself unfettered by the yoke of boredom and I swiftly recovered much of my early curiosity by travelling quickly through basic trigonometry. Gone were the stumbling blocks of look-up tables and I was able to travel down many diversionary "what if's" to see what

really happens when certain values change in mathematical formulae.

But as exciting as all this was, and because much of mathematics requires visual images, I looked forward to a time when, with the help of a small computer, I could generate graphs and figures as well as numbers to excite and satisfy my curiosity.

And so it was that after acquiring an Apple II computer, one of my first exercises was to develop a program



which would use Apple's excellent high-resolution graphics to plot the path of a variety of mathematical expressions. This program is the result and I have had much, much fun with it.

The program was developed on an Apple II with 48K of RAM and an Applesoft ROM card. The entire program takes only slightly more than 3K of RAM, depending on the complexity of the function being plotted.

Those who do not have the Applesoft ROM card may still use this program by changing line 480 to read "HGR2" instead of "HGR" under these circumstances the function plotted formula will not be printed at the bottom of the screen. All other functions work as described.

The heart of the program is line 1010 which contains the function being explored. A typical function is listed here. When run, the program first defines some trigonometric and hyperbolic functions which are not directly available in Applesoft Basic. It then proceeds to plot the X and Y axes. As currently arranged the expression under investigation is plotted as a function of changing angle, from 1 to 360 degrees. By changing lines 670 and 900 other independent variables could be introduced. The program is completely protected against off-scale plotting and automatically scales itself for the range of independent variables selected.

When the plot is completed the program dutifully presents a printout of the function and awaits your pleasure at the push of the return key. It then presents you with a helpful list of all of the additional functions defined by the program in addition to those resident in Applesoft Basic. Line 1010 is listed and the cursor invites your screen editing of this line for further variations.

A word of caution: any attempt to plot mathematical "no-no's" such as square roots or logs of negative values will earn you a quick error message. Do not despair. Use of the ABS command will quickly get you back in business when these values crop up!

This program has all kinds of tinkering possibilities. You might try surrounding line 1010 with a FOR... Next loop to introduce other variable changes and to allow longer expressions than you can

conveniently type into line 1010 all at once. Just beware! This program is subtly laced with a curious narcotic which has been known to keep the user awake all night! Have fun!

u

```

FIST
100 REM *****
110 REM * FUNCTION PLOTTER *
120 REM * BY DAVID P. ALLEN *
130 REM * (C) COPYRIGHT 1980 *
140 REM * APPLESOFT II BASIC *
    Courtesy of Roger Wagner's "VAR-
    DOC"
150 REM *****
160 REM
170 REM
180 REM THIS PROGRAM PLOTS A
190 REM CURVE FOR ANY EXPRESS-
200 REM ION AS A FUNCTION OF
210 REM INCREASING ANGLE FROM
220 REM 1 TO 360 DEGREES.
230 REM CHANGE LINE 1010 TO A
240 REM FUNCTION YOU WISH TO
250 REM PLOT.
260 REM
270 REM
280 REM ** DEFINE FUNCTIONS **
290 REM
300 DEF FN SCH(X) = 2 / ( EXP (
X) + EXP ( - X)): REM SECH
(X)
310 DEF FN CCH(X) = 2 / ( EXP (
X) - EXP ( - X)): REM CSCH
(X)
320 DEF FN CTH(X) = EXP ( - X)
/ ( EXP (X) - EXP ( - X)) *
2 + 1: REM COTH(X)
330 DEF FN SEC(X) = 1 / COS (X)
): DEF FN CSC(X) = 1 / SIN
(X): DEF FN COT(X) = 1 / TAN
(X)
340 DEF FN SNH(X) = ( EXP (X) -
EXP ( - X)) / 2: REM SINH(
X)
350 DEF FN COSH(X) = ( EXP (X) +
EXP ( - X)) / 2: REM COSH(
X)
360 DEF FN TANH(X) = - EXP ( -
X) / ( EXP (X) + EXP ( - X)
) * 2 + 1: REM TANH(X)
370 REM
380 REM
390 REM ** PLOT GRAPH AXES **
400 REM
410 HOME

```

```

420 REM
430 REM MOVE CURSOR TO BOTTOM
440 REM LINE.
450 REM
460 VTAB 24
470 REM
480 HGR
490 HCOLOR= 7
500 HPL0T 0,80 TO 279,80
510 HPL0T 0,16 TO 0,143
520 FOR I = 0 TO 279 STEP 70
530 HPL0T 1,78 TO 1,82: HPL0T 27
9,78 TO 279,82
540 NEXT I
550 FOR I = 16 TO 144 STEP 16
560 HPL0T 0,1 TO 4,1
570 NEXT I
580 REM
590 REM FLAGS FOR FIRST PLOT
600 REM AND SCALE.
610 REM
620 F = 0:G = 0
630 REM
640 REM R1 AND R2 MAY BE SET
650 REM FOR OTHER LIMITS.
660 REM
670 R1 = 1:R2 = 360
680 REM
690 REM
700 REM ** BEGIN PLOT **
710 REM
720 REM CHANGE STEP FOR MORE
730 REM OR LESS RESOLUTION.
740 REM IF R1 > R2 THEN STEP
750 REM MUST BE NEGATIVE.
760 REM
770 FOR I = R1 TO R2 STEP 5
780 REM
790 REM NEXT 3 STEPS ESTABLISH
800 REM HORIZONTAL SCALE.
810 REM
820 IF ABS (R1) > = ABS (R2) THEN
R = ABS (R1)
830 IF ABS (R2) > = ABS (R1) THEN
R = ABS (R2)
840 IF G = 0 THEN S = 70 * 4 / R
:G = 1
850 X = 1:Y = 0
860 REM
870 REM CONVERTS DEGREES TO
880 REM RADIANS.
890 REM
900 X = X * 3.14159 / 180
910 REM
920 REM PREVENTS CRASHING WHEN
930 REM X = 0.
940 REM
950 IF X = 0 THEN X = .00001

960 REM
970 REM
980 REM NEXT LINE DESCRIBES
990 REM FUNCTION TO BE PLOTTED
1000 REM
1010 Y1 = SIN (X) + COS (2 * X)

1020 Y = Y + Y1
1030 Y = Y * 20
1040 REM
1050 REM SCALES X
1060 REM
1070 X = I * S
1080 REM
1090 REM RELATES PLOT TO X AXIS

1100 REM
1110 Y = - Y + 80
1120 REM
1130 REM SUBROUTINE PREVENTS
1140 REM OFF-SCALE CRASHING.
1150 REM
1160 GOSUB 1830
1170 REM
1180 REM PLOTS FIRST POINT.
1190 REM
1200 IF F = 0 THEN HPL0T X,Y:F =
1
1210 HPL0T TO X,Y
1220 NEXT I
1230 PRINT : LIST 1010
1240 REM
1250 REM BLANKS OUT LINE #
1260 REM AFTER LISTING
1270 REM LINE 1010.
1280 REM
1290 POKE 1616,160: POKE 1617,16
0: POKE 1618,160: POKE 1619,
160
1300 REM
1310 REM WAITING FOR YOUR PLEA-
1320 REM SURE! PUNCH 'RETURN'
1330 REM TO CONTINUE!
1340 REM
1350 POKE - 16365,0: WAIT - 16
384,128
1360 REM
1370 REM
1380 REM THROWS PREVIOUS KEY-
1390 REM STROKE AWAY WITH
1400 REM 'GET Z$'!
1410 REM
1420 GET Z$
1430 REM

```

```

1430 REM
1440 REM  CLEAR SCREEN AND
1450 REM  PRINT FUNCTIONS FOR
1460 REM  REMINDER.
1470 REM
1480 TEXT : HOME
1490 PRINT TAB( 9);"SECANT = FN
    SEC(X)"
1500 PRINT TAB( 9);"C0SEC = FN
    CSC(X)"
1510 PRINT TAB( 9);"C0TAN = FN
    C0T(X)"
1520 PRINT TAB( 9);"SINH = FN
    SNH(X)"
1530 PRINT TAB( 9);"C0SH = FN
    C0H(X)"
1540 PRINT TAB( 9);"TANH = FN
    TAH(X)"
1550 PRINT TAB( 9);"SECH = FN
    SCH(X)"
1560 PRINT TAB( 9);"CSCH = FN
    CCH(X)"
1570 PRINT TAB( 9);"C0TH = FN
    CTH(X)"
1580 REM
1590 REM  NOW WE SET UP LINE
1600 REM  1010 FOR EDITING.
1610 REM  'POKE 32, 2' MOVES
1620 REM  MARGIN SO CURSOR CAN
1630 REM  FIT IN FRONT.
1640 REM
1650 VTAB (12)
1660 PRINT "CHANGE LINE 1010 AS
DESIRED AND"
1670 PRINT "RUN AGAIN!"
1680 POKE 32,2
1690 LIST 1010
1700 REM
1710 REM  NOW WE RESTORE MARGIN
1720 REM  AND MOVE CURSOR IN
1730 REM  FRONT OF LINE #.
1740 REM
1750 POKE 32,0
1760 POKE 37,13: POKE 36,0
1770 REM
1780 END
1790 REM
1800 REM  SCALE ANTI-CRASHING
1810 REM  SUBROUTINE.
1820 REM
1830 IF X < 0 THEN X = 0
1840 IF X > 279 THEN X = 279
1850 IF Y < 0 THEN Y = 0
1860 IF Y > 159 THEN Y = 159
1870 RETURN

```

```

*****
*
*      FUNCTION PLOTTER      *
*
*  -->TABLE OF VARIABLES<--  *
*
*****
CCH(*) - HYPERBOLIC C0SECANT
310

C0H(*) - HYPERBOLIC C0SINE
350

C0T(*) - C0TANGENT
330

CSC(*) - C0SECANT
330

CTH(*) - HYPERBOLIC C0TANGENT
320

F - FLAG FOR FIRST PLOT
620 1200 1200

G - FLAG FOR SCALE
620 840 840

I - LOOPING VARIABLE
520 530 530 540 550 560 560
570 770 850 1070 1220

R - SCALE FACTOR
820 830 840

R1 - PLOTTING RANGE - START
670 770 820 820 830

R2 - PLOTTING RANGE - END
670 770 820 830 830

S - SCALE
840 1070

SCH(*) - HYPERBOLIC SECANT
300

SEC(*) - SECANT
330

SNH(*) - HYPERBOLIC SINE
340

TAH(*) - HYPERBOLIC TANGENT
360

```

X - HORIZONTAL PLOTTING VALUE
 300 300 300 310 310 310 320
 320 320 320 330 330 330 330
 330 330 340 340 340 350 350
 350 360 360 360 360 350 900
 900 950 950 1010 1010 1070
 1200 1210 1330 1330 1840 1840

Y - VERTICAL PLOTTING VALUE
 850 1020 1020 1030 1030 1110
 1110 1200 1210 1850 1850 1860
 1860

Y1 - FUNCTION VARIABLE
 1010 1020

Z\$ - KEYSTROKE USERUPPER
 1420

END OF VAR. LIST

~~~~~  
 David P. Allen is founding partner, chairman of the board and executive producer of the Video Picture Company, Inc., Boston.

His technical background includes consulting engineer for Boston Broadcasters, Inc. to design and build a new VHF facility for channel 5 in Boston. Developed and operated for channel 5 the first electronic news gathering mobile unit in New England.

Senior Engineer, consultant for RCA Corp. in designing educational television facilities.

David Allen's other publications include "Television System Design" for the United States Air Force. He is also a contributing editor for Videography Magazine with monthly production column and other articles.

~~~~~  
 Here's a bonus for Atari 400 and 800 computer users. I discovered that with only slight modification the function plotter program runs beautifully on Atari 400 with only 8k of memory. The only feature left off from the Apple program is the list of functions, since the Atari basic has no 'FN' command. Atari users would do well to note that contrary to some Atari instructions, there is not 'TAN' function in Atari basic. The dilemma of this absence is easily overcome by using 'SIN' function divided by 'COS' function wherever a tangent is to be derived. Here is a listing for Atari computers.

μ

```

1 REM FUNCTION PLOTTER PROGRAM
2 REM BY DAVID P. ALLEN
3 REM ATARI FLOATING POINT BASIC
4 REM COPYRIGHT (C) 1980
5 REM
6 REM THIS PROGRAM PLOTS A
7 REM CURVE FOR ANY EXPRESS-
8 REM ION AS A FUNCTION OF
9 REM INCREASING ANGLE FROM
10 REM 1 TO 360 DEGREES.
11 REM CHANGE LINE 2900
12 REM TO A FUNCTION YOU WISH
13 REM TO PLOT.
14 REM
15 REM
40 REM ESTABLISH GRAPH STARTING
41 REM AND ENDING POINTS.
42 REM
43 REM
50 R1=1:R2=360
88 REM
89 REM
90 REM SET GRAPHIC PARAMETERS
91 REM
92 REM
180 GRAPHICS 7
280 COLOR 1
250 SETCOLOR 4,9,4
268 REM
269 REM
270 REM PLOT GRAPH AXIS
271 REM
272 REM
300 PLOT 1,1:DRAWTO 1,80
400 PLOT 1,40:ORANTO 157,40
500 FOR I=0 TO 80 STEP 10
600 PLOT 1,1:ORANTO 3,1
700 NEXT I
800 FOR I=1 TO 158 STEP 39
900 PLOT 1,38:ORANTO 1,42
1000 NEXT I
1100 REM
1110 REM
1120 REM SET FLAGS FOR FIRST PLOT
1130 REM AND SCALE.
1140 REM
1150 REM
2900 F=0:G=0
2010 REM
2020 REM
2030 REM START PLOTTING
2040 REM
2050 REM
2060 REM CHANGE STEP FOR MORE
2061 REM OR LESS RESOLUTION.
2062 REM IF R1/R2 THEN STEP
2063 REM MUST BE NEGATIVE
2064 REM (PRECEDED BY A MINUS
2065 REM SIGN).
2066 REM
2067 REM
2100 FOR I=R1 TO R2 STEP 3
2110 REM
2120 REM
2130 REM NEXT THREE STEPS ESTABLISH
2140 REM HORIZONTAL SCALE.
2150 REM
2160 REM
2200 IF ABS(R1)>ABS(R2) THEN R=ABS(R1)
2300 IF ABS(R2)>ABS(R1) THEN R=ABS(R2)
2400 IF G=0 THEN S=158/R:G=1
2500 X=1:Y=0
2550 REM
2551 REM
2552 REM CONVERT DEGREES TO
2553 REM RADIANS.
2554 REM
2555 REM
2600 X=X*3.14159/180
2650 REM
2651 REM
2652 REM PREVENTS CRASHING WHEN

```

```

2653 REM X=0.
2654 REM
2655 REM
2800 IF X=0 THEN X=1.0E-05
2850 REM
2851 REM
2852 REM NEXT LINE DESCRIBES
2853 REM FUNCTION TO BE PLOTTED.
2854 REM
2855 REM
2900 Y1=SIN(X)*COS(X/2)
3000 Y=Y+Y1
3100 Y=Y*20
3150 REM
3151 REM
3152 REM SCALES X.
3153 REM
3154 REM
3200 X=X*S
3250 REM
3251 REM
3252 REM RELATES PLOT TO X AXIS.
3253 REM
3254 REM
3300 Y=-Y+40
3350 REM
3351 REM
3352 REM SUBROUTINE PREVENTS
3353 REM OFF-SCALE CRASHING.
3354 REM
3355 REM
3400 GOSUB 5000
3450 REM
3451 REM
3452 REM PLOTS FIRST POINT.
3453 REM
3454 REM
3500 IF F=0 THEN PLOT X,Y:F=1
3600 DRAWTO X,Y
3700 NEXT I
3750 REM
3751 REM
3752 REM DISPLAYS EQUATION OF
3753 REM PLOTTED FUNCTION BENEATH
3754 REM GRAPHIC DISPLAY.
3755 REM
3756 REM
3800 LIST 2900
3900 END
5000 IF X<0 THEN X=0
5100 IF X>158 THEN X=158
5200 IF Y<0 THEN Y=0
5300 IF Y>80 THEN Y=80
5400 RETURN

```

```

1 REM FUNCTION PLOTTER PROGRAM
2 REM BY DAVID P. ALLEN
3 REM ATARI FLOATING POINT BASIC
4 REM COPYRIGHT (C) 1980
5 REM
6 REM THIS PROGRAM PLOTS A
7 REM CURVE FOR ANY EXPRESS-
8 REM ION AS A FUNCTION OF
9 REM INCREASING ANGLE FROM
10 REM 1 TO 360 DEGREES.
11 REM CHANGE LINE 2900
12 REM TO A FUNCTION YOU WISH
13 REM TO PLOT.
14 REM
15 REM
16 REM GRAPHICS 8 VERSION
17 REM REQUIRES MINIMUM OF
18 REM 16K RAM MEMORY.
19 REM
20 REM
40 REM ESTABLISH GRAPH STARTING
41 REM AND ENDING POINTS.
42 REM
43 REM
50 R1=1:R2=360
88 REM
89 REM
89 REM

```

```

90 REM SET GRAPHIC PARAMETERS
91 REM
92 REM
100 GRAPHICS 8
200 COLOR 1
250 SETCOLOR 4,9,4
268 REM
269 REM
270 REM PLOT GRAPH AXIS
271 REM
272 REM
300 PLOT 1,1:DRAWTO 1,160
400 PLOT 1,80:DRAWTO 314,80
500 FOR I=0 TO 160 STEP 19.9
600 PLOT 1,1:DRAWTO 6,1
700 NEXT I
800 FOR I=1 TO 314 STEP 78
900 PLOT 1,76:DRAWTO 1,84
1000 NEXT I
1100 REM
1110 REM
1120 REM SET FLAGS FOR FIRST PLOT
1130 REM AND SCALE.
1140 REM
1150 REM
2000 F=0:G=0
2010 REM
2020 REM
2030 REM START PLOTTING
2040 REM
2050 REM
2060 REM CHANGE STEP FOR MORE
2061 REM OR LESS RESOLUTION.
2062 REM IF R1>R2 THEN STEP
2063 REM MUST BE NEGATIVE
2064 REM (PRECEDED BY A MINUS
2065 REM SIGN).
2066 REM
2067 REM
2100 FOR I=R1 TO R2 STEP 3
2110 REM
2120 REM
2130 REM NEXT THREE STEPS ESTABLISH
2140 REM HORIZONTAL SCALE.
2150 REM
2160 REM
2200 IF ABS(R1)>ABS(R2) THEN R=ABS(R1)
2300 IF ABS(R2)>ABS(R1) THEN R=ABS(R2)
2400 IF G=0 THEN S=314/R:G=1
2500 X=I:Y=0
2550 REM
2551 REM
2552 REM CONVERT DEGREES TO
2553 REM RADIANS.
2554 REM
2555 REM
2600 X=X*3.14159/180
2650 REM
2651 REM
2652 REM PREVENTS CRASHING WHEN
2653 REM X=0.
2654 REM
2655 REM
2800 IF X=0 THEN X=1.0E-05
2850 REM
2851 REM
2852 REM NEXT LINE DESCRIBES
2853 REM FUNCTION TO BE PLOTTED.
2854 REM
2855 REM
2900 Y1=SIN(X)*COS(X^2)
3000 Y=Y+Y1
3100 Y=Y*X20
3150 REM
3151 REM
3152 REM SCALES X.
3153 REM
3154 REM
3200 X=X*I*S
3250 REM
3251 REM
3252 REM RELATES PLOT TO X AXIS.
3253 REM
3254 REM
3300 Y=Y+80
3350 REM
3351 REM
3352 REM SUBROUTINE PREVENTS
3353 REM OFF-SCALE CRASHING.
3354 REM
3355 REM
3400 GOSUB 5000
3450 REM
3451 REM
3452 REM PLOTS FIRST POINT.
3453 REM
3454 REM
3500 IF F=0 THEN PLOT X,Y:F=1
3600 DRAWTO X,Y
3700 NEXT I
3750 REM
3751 REM
3752 REM DISPLAYS EQUATION OF
3753 REM PLOTTED FUNCTION BENEATH
3754 REM GRAPHIC DISPLAY.
3755 REM
3756 REM
3800 LIST 2900
3900 END
5000 IF X<0 THEN X=0
5100 IF X>314 THEN X=314
5200 IF Y<0 THEN Y=0
5300 IF Y>160 THEN Y=160
5400 RETURN

```

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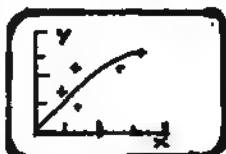


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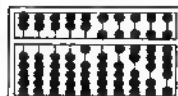
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KIM — VENTURE™

1. **Microcomputers which can use product:** KIM-1
2. **System hardware requirements:** The only requirements are a standard 1K KIM-1 and a Phillips-type cassette tape recorder.
3. **System software requirements:** None.
4. **Product features:** KIM-VENTURE is a fantasy-logic game of the "dungeons and dragons" genre. The objective of the game is to negotiate through a complex maze, find the hidden treasures, and return home with them. The KIM's keypad is used to direct movements and to manipulate the environment, e.g., picking up treasure and various tools along the route. Feedback in the form of present location, hazards, available tools, etc. is provided by cryptic messages written in the KIM alphabet (see "The First Book of KIM").
5. **Product performance:** KIM-VENTURE is programmed in three parts which must be loaded separately. Of the dozen or so times that all three sections were loaded, not a single load error was encountered. The program is well thought through. For example, the LED messages take some time for the inexperienced user to decipher, but provisions have been made to allow the user to lengthen the display time, or to have the messages repeated. The cryptic nature of the display is certainly not a liability. Deciphering the display adds to the mystery and fantasy of the game. Like most "dungeons and dragons" games, KIM-VENTURE has multiple levels of play. As the player gains experience, he discovers new moves and exciting new possibilities to be explored. In short, KIM-VENTURE performs as advertised.
6. **Product quality:** KIM-VENTURE is a well written and very efficient machine language program. It is hard to believe that this program fits into 1K.
7. **Product limitations:** Not applicable.
8. **Product documentation:** The Instructions for loading and playing the game are clearly and completely described. In addition, a complete source listing of the software is provided and is annotated in detail, so that the program can be traced with little difficulty. For the impatient and faithless, the complete solution to the KIM-VENTURE maze is also provided.
9. **Special user requirements:** Other than being able to load a KIM program, there are no special user requirements.
10. **Price/Feature/Quality evaluation:** Priced at \$24.95, KIM-VENTURE is an expensive piece of software; however given the relatively small market for entertainment software for the KIM, the costs of developing this type of software, and the high quality of this package, the tradeoffs are fair.
(Ed's Note: Mr. Leedom will be distributing this program himself and has asked that we mention that he is now able to reduce the price significantly to \$14.95. This 40 % decrease should increase the tradeoff value. To order simply send to the author Robert C. Leedom, 14069 Stevens Valley Ct., Glenwood, MD 21738)
11. **Additional comments:** If you become impatient with problems that take more than a few minutes to solve, or have no understanding of the autistic pleasures of a good puzzle, the KIM-VENTURE would be a poor investment. If, on the other hand, you savor the challenge of solving complex problems, KIM-VENTURE could be a cheap investment, measured in terms of costs per hour of entertainment.
(Ed's note: One major feature of the product which is not mentioned but might be of value; KIM-Venture comes with a fully-documented scoring program which is loaded and run when the game is finished. The scoring program then rates you as having achieved one of eleven levels of skill, and shows you how many moves it took you to get to that level. This allows competition between many players by comparing scores.)
12. **Reviewer:** Dr. Mark H. Meinrath, c/o A.H. Meinrath, 302 Dolphin Place, Corpus Christi, TX 78411

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Tiny PILOT for the AIM

Tiny PILOT is a compact programming language which can add a lot of versatility to your microcomputer. This version has been developed to run on the AIM 65. It is a very inexpensive way to add higher level language capability to your system.

Larry Kollar and Carl Gutekunst
257 W. Wadsworth Hall
Michigan Technological University
Houghton, MI 49931

Nicholas Vrtis' article "Tiny Pilot" (MICRO 16:41) shows that good things still come in small packages. However, a few routines, the editor in particular, can be deleted or replaced when implementing the interpreter with monitor routines on the AIM-65. After tearing the program down, Carl and I finally found the last place needing a CMP -CR inserted and we had enough room left over for two more instructions and a startup message.

The AIM PILOT program is mainly built on the framework of Mr. Vrtis' program, with some small changes to accommodate the new instructions. The first of these, P:ON or P:OFF, simply turns the printer on to off accordingly. To check which way the printer is to be switched, the second letter following the colon is looked at. If this letter is an 'N', the PRIFLG (\$A411) byte is set to \$80. Anything else is assumed to be P:OFF and \$00 is stored in PRIFLG. The remaining letters are then skipped and the next instruction is fetched.

The next instruction, H:ADDR, is a

bit more complicated. This instruction calls a machine language subroutine at the hexadecimal address ADDR then returns to the main program. Fortunately, the monitor routines HEX and PACK do the ASCII to binary conversions easily. The resulting byte is stored in the page zero locations called HEXSUB. An indirect subroutine call is simulated by calling an indirect jump then advancing to the next instruction. H: can be used to escape the limitations of a 768-byte interpreter by adding one's own functions such as multiply routines or random number generators. Computation never was PILOT's strong point...

Obviously, this program will not run on a 1K AIM. Also, entering source code would have been much nicer if Issue 19:37 (HEX LOAD) had loading the retire gets rather tiring, considering that it took about eight tries to make PILOT run on the AIM.

To enter PILOT text on the AIM, use the text editor like always, entering 0500, space, space; and begin writing. I have the F1 function

key set aside to run the interpreter; * = 0200, G, space will serve as well. The interpreter displays its "signon" message, then executes the program. Some final cautions: there are no diagnostics or actual error messages, so debugging can be difficult. On the other hand, PILOT is such an easy language that it would be hard to make a subtle mistake. P: is foolproof enough, but I would recommend using the full address field for the H: routine (four hexadecimal characters).

PILOT is an economical language, both in terms of space and cost. I would not throw the \$100 for the BASIC chips unless I had a video monitor (more money), and the few places Tiny PILOT falls down can be easily worked around. The language is easy to learn, so give it a try.

References

1. Tiny PILOT: An Educational Language for the 6502, Nicholas Vrtis, Micro 16:41.
2. Sharpen your AIM, Robert E. Babcock, Micro 19:37.

[illegible]

[illegible]


```

0444 F005      BEO      SQRAD      . Branch, If end of line
0445 C8        INY      . Else bump to next one
0447 10F7      BPL      FMDI      . Loop if not too many
0449 301C      BMI      SETGN      . Reset to beginning if past the end
044B          .
044B          HERE FIXES UP CURAD TO POINT TO BEGINNING OF A LINE
044B          CURAD SHOULD INDEX END OF LINE (WITH Y) ON EITHER
044B          .
044B          SQRAD INY      . Bump past the CR
044C C8        TYA      . Move count to A
044D 98        CLC      . Clear carry for add
044E 18        ADC      CURAD      . Add to low order first
044F 45D7      STA      CURAD      . And save result
0451 83B7      BCC      SQRJUNK      . Skip if no carry forward
0452 8002      .
***** AIM PILOT - 2RM1A *****
0454 E6B8      INC      CURAD+1      . Else bump high order
0456          .
0456          HERE TO SKIP PAST LEADING JUNK OF A LINE
0456          .
0456          SQRJUNK LDY      #5FF      . Set up Y this way
0458 C8        SLDROP INY      . Increment to next character
045B B1B7      LDA      (CURAD),Y      . Get character to look at
045D 30F5      CMP      #??      . Ignore delete character also
045F C92A      CMP      #??      . Look for '?' label marker
0461 F004      BEQ      SRTS      . Return if found
0463 C93E      CMP      #??      . Look for possible operation character
0465 0F3E      BEC      SLDROP      . Continue skipping if too low
0467 0F3E      BEC      SLDROP      . Set carry for branches after return
0469 38        RTS      . Before return
0467          .
0467          SET UP BEGINNING ADDRESS OF USER AREA
0467          .
0467          SETB31 JSR      CRLF      . Start on a new line
046B A000      LDY      #500      . Even page boundary
046C 9400      STY      LST      . Also set up this guy as default
046E 94EB      STY      CURAD      .
0470 94B7      LDY      #505      . User text starts at $0500
0472 9405      STY      LST+1      .
0474 9401      STY      LST+1      .
0476 A004      LDY      #64      .
0478 94B8      STY      CURAD+1      . Start of stinson message
047A D0DA      BNE      SQRJUNK      . Unconditional
047C          .
047C          COMPUTE INDEX FOR A VARIABLE
047C          .
047C          GETIDX LDA      (CURAD),Y      . Get variable index
047E 38        SEC      .
047F 38        SBC      #41      . Subtract 'A' to make relative to zero
0481 0A        ASL      A      . Times two bytes per variable
0482 0A        TAY      . Move to index register
0483 60        RTS      . And return
0484          .
0484          TRANSFER A VARIABLE'S DATA TO WORK AREA
0484          .
0484          VTRANS JSR      GETIDX      . Get index pointer first
0487 B37C      LDA      VAR1B+1,X      . Now move to work area
0489 8342      STA      WORK+1      .
048B B57B      LDA      VAR1B,X      .
048D 8341      STA      WORK      .
048F 60        RTS      .
0490          .
0490          CONVERT A VARIABLE TO DISPLAY FORM
0490          .
0490          CONVDP JSR      VTRANS      . Move to work area
0493 1017      BPL      ISPLUS      . Branch if positive
0495 A02D      LDA      #?      . Else put in minus sign
0497 83B4      STA      NUMDSF+4      .
0499 F8        SED      . Set decimal mode indicator
049A 38        SEC      .
049B A800      LDA      #500      . Subtract from zero to complement
049D 8342      SEC      WORK+1      .
049F 8342      STA      WORK+1      .
04A1 A800      LDA      #500      .
04A3 8341      SBC      WORK      .
04A5 B341      STA      WORK      .

```

***** AIM PILOT - 2RM1A *****

```

04A7 D8        CLD      . Clear decimal mode
04A8 A203      LDY      #505      . Only 4 positions left
04AA D002      BNE      ISPL1      . Skip index set
04AC          .
04AC          ISPLUS LDY      #504      . Plus has five positions available
04AE 18        ISPL1 LDY      .
04AF 6646      ROR      SIGNIF      . Get first digit
04B1 A541      LDA      WORK      . Put to output area
04B3 20CE04      JSR      TOOUT      . Second digit is high order of this
04B5 A542      LDA      WORK+1      . Move to low order
04B7 4A        LSR      A      .
04B9 4A        LSR      A      .
04BB 4A        LSR      A      .
04BD 4A        LSR      A      .
04BF 20CE04      JSR      TOOUT      . Low order is third digit
04C1 A542      LDA      WORK+1      . See if had any significant chars
04C3 20CE04      JSR      TOOUT      . Skip next if yes
04C5 2446      BIT      SIGNIF      . Else keep the last zero there
04C7 3001      BMI      ISPL2      . Insert end of line marker
04C9 CA        DEX      .
04CB A900      LDA      #500      .
04CD 9380      STA      NUMDSF,X      .
04CE 60        RTS      . And return
04CE          .
04CE          CONVERT CURRENT VALUE TO ASCII AND PUT TO OUTPUT AREA
04CE          .
04CE          TOOUT AND      #50F      . Keep only low order
04D0 0930      ORA      #520      . Make it ASCII
04D2 9380      STA      NUMDSF,X      . Save remainder
04D4 2446      BIT      SIGNIF      . See if significant started
04D6 3005      BMI      SETB31      . Yes--all are important now
04D8 C930      CMP      #520      . Else see if should start now
04DA D001      BNE      SETB31      . Important, if not zero
04DC 60        RTS      . Else return
04DD          .
04DD          SETB31 SEC      . Set significance bit on
04DE 38        ROR      SIGNIF      . Always
04E0 CA        DEX      . And point to next available position
04E1 60        POWEND RTS      . And then return
04E2          .
04E2          START OF STINSON MESSAGE
04E2          .
04E2          * = $04ED
04E3 2A        BYT      #AIM PILOT VER 2R1* . $0D
04E5 2A        .
04E7 41      .
04E9 49      .
04EB 4D      .
04ED 40      .
04EF 20      .
04F0 50      .
04F2 49      .
04F4 4C      .
04F6 4F      .
04F8 54      .
04FA 54      .
04FB 56      .
04FD 52      .
04FF 2E      .
04FF 20      .

```

***** AIM PILOT - 2RM1A *****

```

04FB 32      .
04FD 52      .
04FD 31      .
04FE 2A      .
04FF 0D      .
0500          .
0500          583      .
0500          584      .
0500          END      .
0500          Time      1739 ms      .
0500          No Errors      .
0500          PRESUME EU      .
0500          EOF: 631      .
0500          .

```

[Explanation of the examples]

For demonstration purposes, I have included three example programs. The first program inputs two numbers (one at a time) and puts them into variables A and B, respectively. The two variables are then added together and placed into C. The machine language routines are quick 'n' dirty; i.e. you must enter the numbers as a four-digit string. If you wish to input negative numbers, they must be inputted in 10's complement form. Anyone seriously using these routines would do well to write them over.

The second program demonstrates where Tiny Pilot really

```
R:EXAMPLE #1
R:
R:INPUT TWO NUMBERS,
R:PUT THEM IN A & B,
R:ADD THEM TOGETHER,
R:AND PRINT RESULT.
R:
P:ON
T:FIRST NUMBER= ?
A:
H:0900
R:TRANSFER TO A
T:
T:SECOND NUMBER= ?
A:
H:0980
R:TRANSFER TO B
C:C=A+B
T:
T:THE SUM IS #C
P:OFF
S:
<K>*=0900
/19
0900 48 PHA
0901 20 JSR EB9E
0904 A2 LDX #38
0906 B5 LDA 03,X
0908 20 JSR EA7D
090B CA DEX
090C B5 LDA 03,X
090E 20 JSR EA84
0911 85 STA 7B
0913 CA DEX
0914 B5 LDA 03,X
0916 20 JSR EA7D
0919 CA DEX
091A B5 LDA 03,X
091C 20 JSR EA84
091F 85 STA 7C
0921 20 JSR EBAC
0924 68 PLA
0925 60 RTS
```

ly stands out, which is in educational purposes. After running this program, the user has all he needs to know to load and save programs on tape.

The third program should prove quite useful to anyone who wants to perform program loops. It tests variable A to see if it is equal to zero and sets the match flag if so.

For people who wish to experiment with the H: command, remember the high order byte of A is at \$7B, low order at \$7C. Continue counting up for the locations of other variables. The ANSWER field starts at \$3E and works its way down in memory.

```
<K>*=0980
/19
0980 48 PHA
0981 20 JSR EB9E
0984 A2 LDX #38
0986 B5 LDA 03,X
0988 20 JSR EA7D
098B CA DEX
098C B5 LDA 03,X
098E 20 JSR EA84
0991 85 STA 7D
0993 CA DEX
0994 75 LDA 03,X
0996 20 JSR EA7D
0999 CA DEX
099A B5 LDA 03,X
099C 20 JSR EA84
099F 85 STA 7E
09A1 20 JSR EBAC
09A4 68 PLA
09A5 60 RTS
<I>
*AIM PILOT VER. 2R1*
FIRST NUMBER= ?
70357
SECOND NUMBER= ?
70231
THE SUM IS 588
R:EXAMPLE #2
R:
R:TEACHING PROGRAM--
R:HOW TO USE THE
R:TINY PILOT.
R:
P:ON
T:
T:
T:THIS PROGRAM WILL
T:TEACH YOU HOW TO
T:LOAD AND USE TINY
T:PILOT PROGRAMS.
```

```
T:WHAT'S YOUR NAME?
T:
P:OFF
?:
P:ON
T:OKAY, #?,
T:THE FIRST ITEM OF
T:BUSINESS IS TO
T:LEARN HOW TO LOAD
T:UP THE INTERPRETER
T:INTO MEMORY.
T:
T:DO YOU KNOW HOW TO
T:DO THIS, #? ?
T:
U:B
YJ:L
T:FIRST, MAKE SURE
T:THE CONNECTOR IS
T:HOOKED TO THE TAPE
T:DRIVE AND THE COM-
T:PUTER RIGHT. THEN,
T:TYPE "L" IF YOU
T:ARE IN THE MONITOR
T:OR THE ESCAPE IF
T:YOU'RE SOMEWHERE
T:ELSE, THEN TYPE
T:"L." THE DISPLAY
T:WILL SHOW 'IN='
T:TYPE "T" FOR TAPE,
T:THEN THE DISPLAY
T:WILL SHOW 'F=' FOR
T:THE FILE NAME. OF
T:COURSE, YOU SHOULD
T:TYPE "PILOT". THEN
T:THE COMPUTER WILL
T:ASK FOR THE TAPE
T:DRIVE NUMBER OF
T:THE TAPE YOU WANT.
T:TYPE "1", PUSH THE
T:PLAY BUTTON ON THE
T:TAPE DRIVE, AND
T:HIT RETURN. MAKE
T:SURE THE TAPE IS
T:NOT PAST THE START
T:OF PILOT.
T:THE DISPLAY WILL
T:TELL YOU WHEN IT
T:HAS FOUND PILOT.
T:WHEN THE DISPLAY
T:IS CLEAR, YOU CAN
T:START THE EDITOR
T:AT LOCATION 0500
T:AND TYPE IN OR
T:LOAD IN YOUR TEXT
*LT:DO YOU KNOW HOW
T:TO GET TEXT FROM
T:THE TAPE, #? ?
U:B
```

YJ:E
T:TO LOAD TEXT FROM
T:TAPE INTO THE AIM
T:EDITOR, TYPE "R".
T:THE RESPONSES WILL
T:BE THE SAME AS
T:BEFORE. YOU SHOULD
T:ANSWER WITH THE
T:APPROPRIATE RE-
T:SPONSES. YOU CAN
T:THEN MAKE CHANGES
T:TO THE PROGRAM, AS
T:YOU WILL STILL BE
T:IN THE EDITOR.

T:
*ET:WHEN A PROGRAM
T:IS RUNNING RIGHT,
T:YOU CAN SAVE IT ON
T:TAPE. DO YOU KNOW
T:HOW TO DO THIS?

U:B
YJ:Z

T:TO SAVE YOUR
T:PILOT PROGRAM ON
T:TAPE, MAKE SURE
T:THAT YOU ARE IN
T:THE EDITOR. THEN
T:TYPE "L". AIM WILL
T:DISPLAY "OUT=",
T:YOU TYPE "T". THEN
T:THE DISPLAY WILL
T:PROMPT FOR A FILE
T:NAME. GIVE IT A
T:NAME OF 5 OR LESS
T:CHARACTERS AND HIT
T:RETURN. AIM WILL
T:THEN PROMPT FOR
T:WHICH TAPE DRIVE
T:YOU ARE USING.
T:GIVE IT THE NUMBER
T:OF THE TAPE DRIVE
T:YOU ARE USING.

*ZT:
T:WELL, \$?,
T:THAT'S ALL YOU
T:NEED TO KNOW TO
T:USE TINY PILOT
T:PROGRAMS. GOOD
T:LUCK!

T:
T:
P:OFF
S:
*BP:OFF
R:

M:Y
P:ON
T:
T:
E:

R:EXAMPLE #3
R:
R:THIS PROGRAM WILL
R:DEMONSTRATE HOW
R:TO SET UP A LOOP
R:BY USING THE H:
R:COMMAND TO SET THE
R:MATCH FLAG.

R:
C:A=10
P:ON
T:COUNTDOWN...
*LT:\$A
C:A=A-1
H:0900
R:TEST FOR ZERO AND
R:SET MATCH FLAG IF
R:RESULT IS ZERO.
NJ:L
T:DONE!!
S:

(K)*=0900

/11

0900 48 PHA
0901 A5 LDA 7B
0903 D0 BNE 090F
0905 A5 LDA 7C
0907 D0 BNE 090F
0909 A9 LDA #59
090B 85 STA 02
090D 68 PLA
090E 60 RTS
090F A9 LDA #4E
0911 4C JMP 0905

(C)

AIM PILOT VER. 2R1
COUNTDOWN...

10

9

8

7

6

5

4

3

2

1

0

DONE!!

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MEAN 14: A Pseudo-Machine Floating Point Processor for the APPLE II

Modelled after the Sweet 16, this program supports a large variety of mathematical operations on five-byte floating point values. This 'processor' can greatly simplify and enhance your mathematical processing power.

R.M. Mottola
Cyborg Corp.
342 Western Ave.
Boston, MA 02135

In the beginning of the life of the Apple II computer, an obstacle had to be overcome in the writing of the firmware. As we know, the 6502 is an eight bit microprocessor, but all too frequently routines require numeric operations involving double precision integers. Repeating common operations every time they are required could be done, but it is not very space efficient. For that matter, performing the requisite register set-ups to use some general purpose subroutines can also deplete available memory space, if the routines are called frequently. What was needed was an arithmetic processor that could handle two-byte integers. So, pseudo-machine processor, which in reality, is a machine language program that behaves like a processor.

This elegant solution is called the "SWEET 16 PSEUDO-MACHINE INTERPRETER" and is known and used by many Apple programmers. It lives from \$F689 to F7FA on the F0 Integer Basic ROM found in regular Apple II computers. From a software point of view, it is used very much like you would use a Microprocessor. Programming it requires various instructions and operands. Hand assembly is easy because the instruction set isn't long and the format of the operators is very straight-forward. A popular resident assembler, the Lisa assembler by Randall Hyde, will even assemble Sweet 16 mnemonics.

The Mean 14 pseudo-machine floating point processor was

modelled after the Sweet 16. It too is programmed like a hardware processor. Instead of being designed to process two-byte integers, the Mean 14 can perform many mathematical operations on five-byte floating point values. These values are formatted in the standard Applesoft variable representation described in the Applesoft manual.

What It Is Used For

The Mean 14 processor was written to facilitate floating point machine language programming on an Apple II Plus or a standard Apple II with Applesoft ROM card. Since Apple does not provide any documentation for the floating point routines in Applesoft, it is pretty difficult for those wishing to write floating point routines in assembly language. Even knowing the locations and entry requirements of those routines is only partially helpful if either complex or repetitive functions must be performed. Of course, you could always write your more involved functions in Applesoft Basic, but the Mean 14 will always perform at least ten times as fast and probably much more. The reason for this is simply that the Mean 14 has little of the interpreter overhead that Applesoft has. Using the example of adding two values, if Applesoft is used, and the values are represented as variables which have not been used before, Applesoft must allocate space for them first. And if arrays have been dimensioned, they must be moved up to make space for the new variables. If the variables or ar-

rays happen to collide with strings, then string "house-cleaning" must take place. In machine terms, all this takes an awful lot of time. As an added kicker, even more time must be allowed if you use constants instead of variables.

On the other hand, Mean 14 doesn't have to do all of this. Its interpreter overhead is very small and since you, the programmer, supply the operand either by specifying pointers or, in the Immediate Mode, by actually supplying the floating point value, the floating point routines don't have to search for or convert anything. Mean 14 spends its time processing numbers — not trying to find them or converting ASCII strings into them.

What It Does

Mean 14 is a very simple kind of interpreter. You give it a number and it looks it up in a table where it picks up the address of the subroutine which performs the specific function required. Most of those functions already exist in Applesoft. Some require set-ups to make entry and exit easier. In all cases, the instruction set has been designed to make straight line machine language floating point arithmetic a lot easier.

That last line indicates one of the possible shortcomings of the Mean 14 for your particular floating point requirement. It can process data only in a straight line. At present, it contains no conditionals in the instruction set. This apparent problem

isn't really all that bad when you actually use the Mean 14. For my own applications, I've found that testing, branching, and loop operations can best be handled outside of Mean 14, in 6502 assembly language. This is because, relative to the amount of time it takes even the simplest floating point operation to execute, all sorts of branching and testing, including entries and exits into and out of Mean 14, can be accomplished very quickly. For this reason, conditionals were left out of the Mean 14's instruction set. But that certainly doesn't mean that you couldn't add them if you particular application required them.

Using Mean 14

Making use of the Mean 14 processor in you machine language programs is easy. The only prerequisite, besides a working knowledge of assembly language, is a fundamental knowledge of the format of Applesoft variables. For more on this, including a handy utility program that converts any value to its floating point equivalent, see the predecessor to the article, "Applesoft Floating Point Routines, MICRO 27:53". Once this is understood, Mean 14 assembly is very straight-forward.

1. Note that Mean 14 and the Applesoft subroutines that it calls could leave any and all registers in an undeterminable state. If you need certain registers in specific states, it's a good idea to write your self both a Save and a Restore routine and remember to JSR to the Save before entering Mean 14. You could even add these routines to the Mean 14 entry and exits if you like.

2. Enter Mean 14 with a JSR to MEAN14 (\$8E00 in the source listing provided.) All code between this JSR and a Mean 14 "RET" will be interpreted by the Mean 14 processor. Remember that byte sequence is a function of the addressing mode. In the Implied mode, any operator is followed by the next operator. In Immediate mode, an operator is immediately followed by a five byte operand (constant) in Applesoft floating point variable format. In the Absolute mode, the operator must be followed by a two byte pointer to the first memory location containing a floating point value. In the Im-

direct mode, the operator is followed by a pointer which points to a pointer which points to a floating point value. Remember, all pointers must be in standard 6502 low-byte, high-byte order.

3. Consider the following section of code:

```
2000 SUB1      STY YSAVE      ; SAVE Y
2002          STX XSAVE      ; SAVE X
2004          JSR MEAN14     ; ENTER MEAN 14
2007          DFB C0 00 03   ; *LDA $300
200A          DFB C4 05 03   ; *ADD $305
200D          DFB 45 81 00   ;
2010          DFB 00 00 00   ; *SUB #1
2013          DFB 0C        ; *ABS
2014          DFB 81 40 03   ; *STA ($340)
2017          DFB 11        ; *RET
2018          LDX XSAVE      ; RESTORE X
201A          LDY YSAVE      ; RESTORE Y
201C          RTS
```

Both the X and Y registers were saved before entering Mean 14 in this example. To make the code representation less confusing, it's a good idea to show the Mean 14 mnemonic equivalents of the defined bytes in the comments field. I like to designate them with an asterisk but any appropriate scheme should do.

4. If your machine language routines are to be called from Basic and if values obtained from Mean 14 operations will be used by Basic, you might want to store values directly into the memory locations allocated to Applesoft variables. This will make the results of your machine language calculations directly available to Basic. Although there are subroutines in Applesoft to fine a variable by its name, they can take a lot of time to execute. An easier approach is to "know" where your variables are by allocating them first, in your Basic program. Thus, if the first line of your program is:

```
10 A=0:B=0:C=0:D=0
```

then you'll know that the first variable is A, the second is B, etc. The pointer at locations \$69,\$69A tells you the beginning of the simple variable space, so you should be all set.

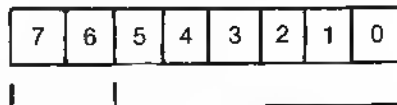
5. Be careful to avoid floating point errors such as Overflow and Division by Zero, as Applesoft routines tend to dump you into Basic if an error occurs. A scheme to avoid this has also been outlined in "Applesoft Floating Point Subroutines".

6. Good Luck!

μ

Format Of Mean 14 Operators

Mean 14 instructions are represented as single byte numeric values. Two quantities are represented in this byte — instruction and addressing mode. Since there was room to spare (there are only four addressing modes and twenty some-odd instructions) a very simple scheme was devised to include both. There are also many unused values so the instruction set could easily be expanded. An instruction is represented with the two high order bits indicating the addressing mode and the lower six bits indicating the operation



Addressing Mode Instruction

Mean 14 Addressing Modes

The Mean 14 pseudo-machine processor instructions use four different addressing modes. They are:

IMMEDIATE
ABSOLUTE
INDIRECT
IMPLIED

IMMEDIATE: Just like any processor, the Mean 14 instructions

that allow immediate addressing use the value following an operator in memory for the operand. Since we deal with floating point values, the five memory locations following the operator must contain the floating point operand. this must be in Applesoft variable format.

EX. Load FPAC1 with the value "0"

```

40      00 00 00 00 00      LDA#0
  \      \      \
OPERATOR OPERAND  SYM-
BOLIC

```

ABSOLUTE- The two bytes that follow the instruction (operator) in the absolute mode must contain the address of the first byte of the desired buffer.

EX. Store FPAC1 in locations \$1F00-\$1F04

```

C1      00 1F      STA $1F00-$1F04
  \      \      \
OPERATOR OPERAND  SYM-
BOLIC

```

INDIRECT- In this addressing mode, the two bytes that follow the operator must contain the address of a two byte pointer which points to the first byte of the buffer. This addressing mode is useful when loop processing an number of variables. It allows the pointer to the variable to be changed and, since the pointer is not a part of the Mean 14 object code, you needn't write self modifying code to perform a loop. Again, both the operand and the pointer must be represented in the low byte, high byte format.

EX. Store FPAC1 in \$2FF0-\$2FF4

```
81 00 20      STA($2000)
```

Where \$2000,\$2001 point at \$2FF0

IMPLIED- Certain Instructions perform operations which do not involve variables. There include register functions and exits from Mean 14.

EX. Transfer FPAC1 to FPAC2

```
02      TAB
```

EX. Exit Mean 14

```
11 RET
```

MEAN 14 INSTRUCTION SET

```

LDA      Load FPAC1 with memory          M --> FPAC1
        IMMEDIATE = $40
        ABSOLUTE  = $C0
        INDIRECT  = $80

```

```

STA      Store FPAC1 in memory            FPAC1 --> M
        ABSOLUTE  = $C1
        INDIRECT  = $81

```

```

TAD      Transfer FPAC1 to FPAC2          FPAC1 --> FPAC2
        IMPLIED   = $02

```

```

TBA      Transfer FPAC2 to FPAC1          FPAC2 --> FPAC1
        IMPLIED   = $03

```

```

ADD      Add memory to FPAC1              M + FPAC1 --> FPAC1
        IMMEDIATE = $44
        ABSOLUTE  = $C4
        INDIRECT  = $84

```

```

SUB      Subtract FPAC1 from memory        M - FPAC1 --> FPAC1
        IMMEDIATE = $45
        ABSOLUTE  = $C5
        INDIRECT  = $85

```

```

MUL      Memory times FPAC1                M * FPAC1 --> FPAC1
        IMMEDIATE = $46
        ABSOLUTE  = $C6
        INDIRECT  = $86

```

```

DIV      Memory divided by FPAC1           M / FPAC1 --> FPAC1
        IMMEDIATE = $47
        ABSOLUTE  = $C7
        INDIRECT  = $87

```

```

NOP      No operation                      MPC + 1
        IMPLIED   = $08

```

```

SQR      Square root of FPAC1              SQR FPAC1 --> FPAC1
        IMPLIED   = $09

```

```

EXP      FPAC2 raised to the power        FPAC2 ^ M --> FPAC1
        of memory
        IMMEDIATE = $4A
        ABSOLUTE  = $CA
        INDIRECT  = $8A

```

```

INT      Integer value of FPAC1          INT ( FPAC1 ) --> FPAC1
      IMPLIED      = $0B

-----

ABS      Absolute value of FPAC1          ABS ( FPAC1 ) --> FPAC1
      IMPLIED      = $0C

-----

SGN      Value of the sign of
      FPAC1                              SGN ( FPAC1 ) --> FPAC1
      IMPLIED      = $0D

-----

LOG      Natural log of FPAC1             LOG ( FPAC1 ) --> FPAC1
      IMPLIED      = $0E

-----

CVA      Convert two-byte integer
      in Applesoft integer variable
      format to its floating point
      equivalent.                        M% --> FPAC1

      ABSOLUTE     = $CF
      INDIRECT      = $8F

-----

CVB      Convert two-byte integer
      in 6502 format to its floating
      point equivalent.                  ML, MH --> FPAC1

      ABSOLUTE     = $D0
      INDIRECT      = $90

-----

RET      Exit MEAN 14                    MPC --> PC
      IMPLIED      = $11

```

```

**END OF PASS 1
**END OF PASS 2

```

```

0800      , *****
0800      ; *
0800      ; *      MEAN-14      *      0800      FPLOAD EQU $EAF9
0800      ; *      PSEUDO-MACHINE *      0800      FPSTR  EQU $EB2B
0800      ; *      FLOATING POINT *      0800      TR2>1 EQU $EB53
0800      ; *      PROCESSOR V1.0 *      0800      TR2>2 EQU $EB63
0800      ; *      *      0800      FPSGN  EQU $EB90
0800      ; *      R. M. MOTTOLA *      0800      FPABS  EQU $EBAF
0800      ; *      10/79      *      0800      FPINT  EQU $EC23
0800      ; *      *      0800      FPSQR  EQU $EE8D
0800      ; *****      0800      FPEXP  EQU $EE94
0800      ;      0800      ;
0800      ;      8E00      ORG $8E00
0800      ;      8E00      OBJ $800
0800      ; SOFTWARE ADDRESSES      8E00      ;
0800      ;      8E00      ; MEAN 14 PSEUDO-MACHINE
0800      ;      8E00      ; FLOATING POINT PROCESSOR
0800      ;      8E00      ;
0800      ;      8E00      MEAN14 PLA      , GET M14 CODE LOCATION
0800      ;      8E00      STA MPCL      ; FROM RETURN ADDRESS
0800      ;      8E01 854C      PLA
0800      ;      8E03 68      STA MPCH
0800      ;      8E04 854D      JSR PCINC
0800      ;      8E06 205F8E      M14A JSR M14B
0800      ;      8E09 200F8E      JMP M14A
0800      ;      8E0C 4C098E      M14B LDY #$0
0800      ;      8E0F A000      LDA (MPCL),Y      ; GET ONE INSTRUCTION
0800      ;      8E11 B14C      TAX
0800      ;      8E13 AA      AND #$3F      ; GET CORRECT SUBROUTINE
0800      ;      8E14 293F      ASL      ; ADDRESS FROM TABLE
0800      ;      8E16 0A
0800      ; FIRMWARE ADDRESSES
0800      ;
0800      ; INTDFF EQU $E2F2
0800      ; FPSUB EQU $E7A7
0800      ; FPADD EQU $E7BE
0800      ; FPLOG EQU $E941
0800      ; FPMUL EQU $E97F
0800      ; FPDIV1 EQU $EA66

```

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```

8E17 A8      TAY
8E18 C8      INY
8E19 B9A08E  LDA SUBTBL,Y ;AND SHOVE 1T
8E1C 48      PHA
8E1D 88      DEY
8E1E B9A08E  LDA SUBTBL,Y
8E21 48      PHA
8E22 205F8E  JSR PCINC ;INCREM. M14 P.C. COUNT
8E25 9A      TXA
8E26 29C0    AND #*C0 ;GET ADDRESSING MODE
8E28 F034    BEQ M14G ;IMPLIED?
8E2A 1020    BPL M14D ;IMMEDIATE?
8E2C 2940    AND #*40
8E2E D013    BNE M14C ;ABSOLUTE?
8E3D B14C    LDA (MPCL),Y ;INDIRECT
8E32 851E    STA TEMPL ;GET POINTER TO ADDRESS
8E34 C8      INY ;OF OPERAND
8E35 B14C    LDA (MPCL),Y
8E37 851F    STA TEMPH
8E39 88      DEY
8E3A B11E    LDA (TEMPL),Y
8E3C 48      PHA
8E3D C8      INY
8E3E D11E    LDA (TEMPL),Y
8E40 48      PHA
8E41 9013    BCC M14E
8E43 B14C    LDA (MPCL),Y ;GET ADDRESS OF
8E45 48      PHA ;OPERAND
8E46 C8      INY
8E47 B14C    LDA (MPCL),Y
8E49 48      PHA
8E4A 900A    BCC M14E
8E4C A54C    LDA MPCL ;SAVE P.C. AS ADDRESS
8E4E 48      PHA ;OF IMMEDIATE OPERAND
8E4F A54D    LDA MPCH
8E51 48      PHA
8E52 A905    LDA #*5 ;AND OFFSET P.C. 5 BYTES
8E54 9002    DCC M14F
8E56 A902    LDA #*2 ;OFFSET P.C. 2 BYTES
8E58 20618E  JSR PCADD
8E5B 68      PLA ;PULL OPERAND ADDRESS
                        AND TRANSFER
                        ; TO A AND Y REGS FOR SUBS
8E5C A8      TAY
8E5D 68      PLA
8E5E 60      M14G RTS ;JMP VIA RTS
8E5F
8E5F A901    PC1NC LDA #*1
8E61 18      PCADD CLC
8E62 654C    AOC MPCL
8E64 854C    STA MPCL
8E66 9003    BCC PC1
8E68 E64D    INC MPCH
8E6A 18      CLC
8E6B A000    PC1 LDY #*0
8E6D 60      RTS
8E6E
8E6E AA      STR TAX
8E6F 4C2BEB  JMP FPSTR
8E72 851E    CONV1 STA TEMPL
8E74 841F    STY TEMPH
8E76 A000    LDY #*0
8E78 B11E    LDA (TEMPL),Y
8E7A 48      PHA
8E7B C8      INY
8E7C B11E    C1A LDA (TEMPL),Y
8E7E A8      TAY
8E7F 68      PLA
8E80 20F2E2  JSR INT>FP
8E83 A5A2    LDA FPAC1+*5
8E85 1007    BPL NOOP
8E87 A9C4    LDA #VALUE1
8E89 A08E    LDY /VALUE1
8E8B 20BEE7  JSR FPADD
8E8E 60      NDDP RTS
8E8F 851E    CONV2 STA TEMPL
8E91 841F    STY TEMPH
8E93 A001    LDY #*1
8E95 B11E    LDA (TEMPL),Y
8E97 48      PHA
8E98 88      DEY
8E99 F0E1    BEQ C1A
8E9B 68      RETURN PLA ;PULL MEAN 14 RETURN
8E9C 68      PLA ;ADDRESS FROM STACK
8E9D 6C4C00  JMP (MPCL)

8EA0
8EA0
8EA0 ;SUBROUTINE ADDRESS TABLE
8EA0
8EA0 F8EA    SUBTBL ADR FPLDAD-#1
8EA2 6D8E    ADR STR-#1
8EA4 62EB    ADR TR1>2-#1
8EA6 52E8    ADR TR2>1-#1
8EA8 BDE7    ADR FPADD-#1
8EAA A6E7    ADR FPSUB-#1
8EAC 7EE9    ADR FPMUL-#1
8EAE 65EA    ADR FPDIV1-#1
8EB0 8D8E    ADR NOOP-#1
8EB2 3CEE    ADR FPSQR-#1
8EB4 93EE    ADR FPEXP-#1
8EB6 22EC    ADR FP1NT-#1
8EB8 AEE8    ADR FPABS-#1
8EBA 8FEB    ADR FPSGN-#1
8EBC 40E9    ADR FPLOG-#1
8EBE 718E    ADR CONV1-#1
8EC0 8E8E    ADR CONV2-#1
8EC2 9A8E    ADR RETURN-#1
8EC4
8EC4 ;FLOATING POINT CONSTANTS
8EC4
8EC4 910000    VALUE1 HEX 9100000000 ; % 65536
8EC7 0000
8EC9
8EC9
8EC9
8EC9 LENGTH EDU *-MEAN14
8EC9 END END

*****
*
* SYMBOL TABLE -- V 1.5 *
*
*****

LABEL. LOC. LABEL. LOC. LABEL. LOC.

** ZERO PAGE VARIABLES:

TEMPL 001E TEMPH 001F MPCL 004C
MPCH 004D FPAC1 009D FPAC2 00A5

TEMPL 001E TEMPH 001F MPCL 004C
MPCH 004D FPAC1 009D FPAC2 00A5
INT>FP E2F2 FPSUB E7A7 FPADD E7BE
FPLOG E941 FPMUL E97F FPDIV1 EA66
FPLOAD EAF9 FPSTR EB2B TR2>1 EB53
TR1>2 EB63 FPSGN EB9D FPABS EBAF
FPINT EC23 FPSQR EE8D FPEXP EE94
MEAN14 8E00 M14A 8E09 M14B 8E0F
M14C 8E43 M14D 8E4C M14E 8E56
M14F 8E58 M14G 8E5E PCINC 8E5F
PCADD 8E61 PC1 8E6B STR 8E6E
CONV1 8E72 C1A 8E7C NOOP 8E8E
CONV2 8E8F RETURN 8E9B SUBTBL 8EA0
VALUE1 8EC4 END 8EC9

```

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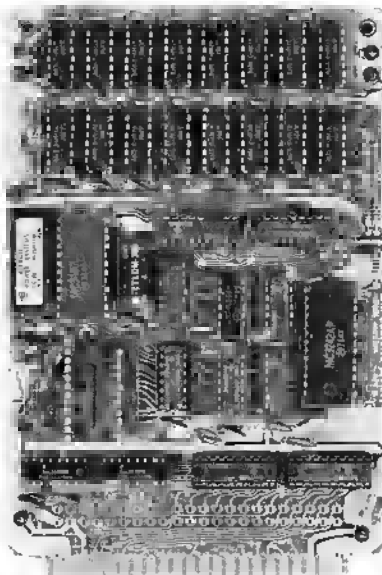
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The MICRO Software Catalog: XXIV

Software announcements for the 6502 based systems

Mike Rowe
P.O. Box 6502
Chelmsford, MA 01824

Name: Spaad Raading and Comprahension
System: PET/CBM
Memory: 16 or 32K
Hardware: cassette drive
Description: A flexible and comprehensive system in which the teacher creates a permanent test and question data file on a cassette. This file is used by one of the other programs to give a rapid scan, and then a timed read scan, followed by questions which are corrected. All statistics including reading speed, in words per minute, are then printed on the screen (printer optional). The system has many options including: adjustable read rate, various methods of displaying the text for reading, and directions for customizing the programs for individual perterences and teaching strategies.
Copies: Just released
Price: \$49.95 (extra manuals, \$2.00)
Includes: Six programs, sample data file, manual, all in a six cassette plastic binder
Author: Richard A. Brown, Ph.D.
Available: Abbott Educational Software
334 Westwood Avenue
E. Longmeadow, MA 01028

Name: WP-INT
System: Ohio Scientific
Memory: 48K RAM
Language: Basic, 6502 Assembler
Hardware: C2-OEM and C3 series
Description: A form letter generation package that unites two OSI software systems, WP-2 and OS-

DMS. The system extracts information from OS-DMS data files to prepare from letters with OSI's word processor, WP-2. Supplied on two floppy disks.

Price: \$80.00
does not include OS-DMS or WP-2
Available: DCS Software Products
2729 Lowery Court
Zion, IL 60099

Name: Copy T-File
System: Apple II, Appte II plus
Memory: 16K with ROM
32K without
Language: Applesoft
Hardware: Disk II
Description: Copies any EXEC file or sequential TEXT file to another disk. You can display the files field by field and directly change any field in the TEXT file before copying. Modify your own EXEC programs directly without going thru the 'Make-EXEC' routine. Lets you display and study professional EXEC programs. Self-prompting. Simple and easy to use.
Price: \$15.95
Includes: Disk with program and instructions
Author: David Weston
Available: David Weston
P.O.Box 25943
Los Angeles, CA 90025

Name: Supersort
System: PET/CBM computers
Memory: 851 bytes at the top of memory, plus parts of the second cassette buffer. The demo program uses 7k.
Language: Machine, the loader and demonstrator pro-

grams are in Basic.
Description: Enhanced version of KEYSORT (MICRO 23 & 24). It shares KEYSORT's advantages, and adds several features requested by MICRO readers: Sorts 1 or 2 dimension arrays of strings or integers on any of up to 127 fields, with optional subsorting on match to any other field or fields, all in ascending or descending order. Delimiters are not needed with this, and data may be easily viewed without using Mtd\$ functions needed by KEYSORT.

Copies: Just released
Price: \$34.95
Includes: full instructions, complete demo program, assembly source listing
Author: James Strasma
Available: Programma International
3400 Wilshire Blvd.
Los Angeles, CA 90010

Name: Video Massaga Display
System: Appte II
Memory: 48K RAM
Language: Apple Integer Basic
Hardware: Color tv set, RF Modulator or color Video Monitor, Mountain Hardware Clock, Apple Disk Drive

Description: Converts a computer into an electronic bulletin board. A set of simple commands allows the user to define a series of "slides" that can be displayed in any sequence and for varying amounts of time. Low resolution displays other normal-sized characters in normal,

reverse, or blinking video. High resolution Displays permit intermixed characters of three different sizes in either normal or reverse video. In addition, the background of the "slide" can be displayed in any high resolution color. Professional version, model VMP, is available for the Apple II. Provides hardcopy slide logs for use by television stations.

Price: VMD—\$149.00
VMP—\$199.00

Available: **Serendipity Systems, Inc.**
225 Elmira Road
Ithaca, N.Y. 14850

Name: **Micro-Inventory (MIN)**
System: Apple II, Applesoft
Firmware Board
Memory: 48K RAM
Hardware: Tv set, RF modulator
or video Monitor, Apple
disk drive, Optional printer

Description: Developed with the particular needs of small businesses in mind, this package provides owners of such firms with effective inventory control. Each inventory item is assigned a unique item identifier by the user, and data is stored in logical files. Although the capacity of the system is normally limited to six files of 200 items each, multiple diskette drives can be used to accommodate additional inventory items. Reports provided include Items On File, Items On Hand, Items On Order, etc. Each report can be generated to include all inventory items or only those specified by the user.

Price: \$149.00

Available: **Serendipity Systems, Inc.**
225 Elmira Road
Ithaca, N.Y. 14850

Name: **Micro-General Ledger**
System: Apple II Plus, Apple II
w/Applesoft Firmware Board
Memory: 48K RAM
Language: Apple Integer BASIC
Hardware: Tv set with RF
modulator or video
monitor, Apple disk
drive

Description: Designed with the needs of very small businesses in mind, MGL allows the user to retain financial control while requiring a minimum knowledge of accounting. It features a user-defined chart of

accounts, interactive data entry and editing routines, extensive error detection devices, and automatic end-of-month and end-of-year resetting of totals. Reports produced include Sheet, and an Accounts Reconciliation Report. The system can accommodate 75 accounts and each account may be assigned a total of nine sub-account numbers.

Price: \$149.00

Available: **Serendipity Systems, Inc.**
225 Elmira Road
Ithaca, N.Y. 14850

Name: **AMS/OIL Inventory/Sales/Price List**

System: Apple II
Memory: 32K
Language: ROM Applesoft
Hardware: Disk II

Description: Program maintains price list, handles sales both retail and wholesale, with or without shipping, maintains inventory with monthly and year-to-date formats. Creates, sorts and provides easy update to price lists. Can be used for AMWAY as well.

Price: \$30.00 Includes disk
\$15.00 w/o inventory
program

Author: **Allan Blackburn**
Available: **AWB's**
1226 Wade Hampton
Fort Worth, TX 76126

Name: **Satellite**
System: Apple II, Apple II plus
Memory: 32K
Language: Applesoft ROM/RAM
Description: Provides the amateur radio operator or shortwave listener with all data necessary to track spacecraft in either circular or elliptical orbits. It will provide enough information so the operator can aim an antenna at the spacecraft and keep up with it as it crosses the sky. The program has two main modes. Information for the satellites is provided in a number of publications, including OST, Worldradio, and '73 magazines. Program to screen or printer.

Copies: Just released

Price: \$14.95 cassette, or
user provided diskette
\$19.95 on diskette by
author, postpaid.
Specify Applesoft
RAM or ROM

Author: **Al Jensen WA7TIB**
Available: **Al Jensen**
19111 First Avenue

NW
Seattle, WA 98177

Name: **The Voice**
System: Apple II, Apple II plus
Memory: 48K
Hardware: No special
Description: Gives your apple the power of speech! Use the standard voice vocabulary to speak an endless combination of phrases and sentences, or easily record your own vocabulary set to make your Apple say anything you like. Each data disk can store up to 80 words or phrases which can be sorted for quick reference. What's more, the Voice allows you to speak from any Basic program by using Print Commands. Guaranteed to be the best Apple voice program available at any price.

Price: \$39.95 disk

Available: **Muse Software**
330 N. Charles Street
Baltimore, MD 21201

Name: **Elementary Math Edu-Disk**

System: Apple II
Memory: 48K
Language: Integer Basic
Description: Written and designed by a professional educator. Contains an arithmetic readiness test and four interactive lessons designed to teach elementary math skills on nine different skill levels. This program is self-demonstrating and requires little or no instructor assistance. Recommended for the student with no prior arithmetic experience, and as a supplement in higher level remedial situations.

Price: \$39.95 disk

Available: **Muse Software**
330 N. Charles Street
Baltimore, MD 21201

Name: **Inventory Program**
System: Apple II, Apple II Plus
Memory: 48K (Firmware card on Apple II)
Language: Applesoft, Assembly
Hardware: 2 Disk drives, 132
column printer

Description: Maintains a complete inventory on up to 800 items. Every category included to back order as well as LOC, COST, etc. Generates search reports, keeps running account of what was sold YTD and much more.

Price: \$140.00 with manual

Author: **Gary E. Haffer**
Available: **Software Technology
for Computers**
P.O.Box 428
Belmont, MA 02178

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Sound business management requires you to keep up-to-date reports regarding the status of your accounts receivable.

Now, from the same company that revolutionized accounting on the Apple II computer, with their conversion of the Osborne/McGraw-Hill General Ledger program, you may now obtain the Accounts Receivable package you have been waiting for.

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In the final analysis, making your bookkeeping easier is what our software is all about. With our General Ledger package you can format your own balance sheet and income statement. Department financial statements may be formatted differently. You have complete freedom to place titles and headings where you want them, skip lines or pages between accounts and generate subtotals and totals throughout the reports—up to ten levels if you need them. Accounts Receivable is designed to provide you with complete up-to-date information. The program will print customer statements as well as post invoice amounts to any of the accounts maintained by our General Ledger package. These packages will support any printer/interface combination. General Ledger requires 110 columns, Accounts Receivable requires 130 columns.

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Up to 1000 records with a maximum of 20 headers (categories) and 10 report formats (user defined) can be stored on a single diskette. Information can be sorted on any header, both ascending and descending in alpha/numeric field. Mathematical functions can be performed on any 2 fields to manipulate the information. Information can be searched on any header using >, <, =, >=, <=, and first letter. Mailing list format provided. Fast assembly language sort, search and read routines. Many error protection devices provided. Put your application program together in minutes instead of hours.

PROGRAM DISKETTE and instruction manual...\$100.00

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2 disk drives, menu-driven program. Inventory categories include: STOCK#, DESCRIPTION, VENDOR ID, CLASS, LOCATION, REORDER PT., REORDER QTY, QTY ON HAND. All records can be entered, changed, updated, deleted, or viewed. Reports can be sorted in ascending/descending order by any category. There are 7 search reports (3 automatic). Calculates \$ VALUE of inventory and YTD, MTD, and period items sold. Accumulates inventory over a 13-month period. Plus much more. Requires a 132-column, serial/parallel printer. Complete turnkey operation with bootstrap diskette.

Program diskette and instruction manual...\$140.00

PAYROLL PACKAGE

2 disk drives, menu-driven program. Employee history include: NAME, ADDRESS #, ADDRESS #2 CITY, STATE, ZIP, FED EX, STATE EX, SOCIAL SEC.#, DATE EMPLOYED, DEPT #, CODE, EMPLOYEE #, STATUS, MARITAL STATUS, PAY RATE, OT RATE, VAC RATE, # VAC HRS. and PENSION PLAN. Program can generate weekly or biweekly payroll. Prints W-2, QTR REPORT, PAY CHECKS, MASTER AND CURRENT TILES. FEDERAL and STATE withholding taxes are built into program. Maintains a CASH DISBURSEMENT journal. Accumulates payroll for a 53 week period. Generates numerous type of payroll reports. Allows data to be searched, sorted and edited. Prints DEDUCTION register and more. Maintain up to 125 EMPLOYEES/EXPENSES for quick and easy PAYROLL. Numerous error protection devices provided.

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6502 Bibliography: Part XXIV

Continuing bibliography of 6502 related material

Dr. William R. Dial
438 Roslyn Avenue
Akron, OH 44320

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Use the General Instruments AY3-8910 device to generate music on 6502 boards.
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READ/WRITE timing on the 6502
- Rehnke, Eric, "Read PET Tapes with Your AIM," Pg. 110-112
This program opens up PET software to the AIM owners.
- Herman, Harvey B., "KIMEX — 1," pg. 113
PROM, RAM and I/O expansion for the KIM
- Carlson, Edward H., "Fast Tape Read/Write Programs for your OSI," Pg. 115-117
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Pep up your Apple Integer Programs with Hires Graphics.
- Anon, "Programming Tips," pg. 15-16.
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Make this useful utility into an Exec program, for the Apple.
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A listing in Integer for this game on the Apple.
- Micklus, Lance and Summers, Murray R., "Treasure Hunt," pg. 33-34.
Listing for this Adventure-type game.
- Gross, Mark, "Bouncing Ball Catcher," pg. 46-47
An Applesoft program employing Hi-Res graphics.
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A game for the Apple.

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- Lindsay, Len, "Pet Games," pg. 11.
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- Hatch, Larry, "Raging Robots," pg. 34-35.
Landmine the PET Screen to outsmart the robots.
- Keyser, Earl, "Frogs for the Apple," pg. 34-35.
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- Wood, Don, "Word Processing with Your Apple," pg. 68-70.
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Notes on PET Basic.

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A continuation of a discussion of multiple user systems.

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Slow down the rate at which characters are displayed on the AIM display.

- Sellers, George, "KIM-4 Motherboard," pg. 6.
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Put your advertising message on the SCROLLING WONDER.

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A two-person game for the Apple graphics.
- Sander-Cederlof, Bob, "Jig-Saw Puzzle," pg. 28-29.
Try your hand at assembling a jig-saw puzzle on the Apple.
- Crossman, Craig, "The Invisible Signature," pg. 32-33.
Put your own label within your Apple program and hide it!
- Sander-Cederlof, Bob, "Space War," pg. 35-37.
A two player graphics game for the Apple.
- Kapur, Mitch, "Melody," pg. 40-47.
Create and save your melody using this Apple program.
- Blackwood, George H., "Intimate Instructions in Integer Basic," pg. 49-52.
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- Anon., "Display Control Characters," pg. 52.
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- Lindsay, Len, "Atari in Perspective," pg. 22-30.
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- Bradford, William, "Ten to the Thirty-Eighth," pg. 104-110.
Here is a game called GOOGOL for the Apple.
- Carpenter, Chuck, "Apple-Cart," pg. 122-129.
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- Headland, Rex, "Dollar Formatting Gosub," pg. 4-5.
A dollar formatting routine for the Apple.
- Wagner, Roger, "Exceeding the Speed Limit with your Apple II," pg. 8.
How to speed up your Apple program.
- Lipson, Neil D., "An Improved Hi-Res Light Graph," pg. 11-12.
Display up to five color graphs on the same screen.
- Wagner, Roger, "Fast GR-Screen Clear," pg. 14.
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Type strange characters with special key combinations on the Apple.
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Some notes on computer accessory advertising and supply practices.
- Martin, Bill, "Crossing Your Wires," pg. 17-18.
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- Busdiecker, Roy, "The Number Game: An Introduction to Computer Arithmetic," pg. 20-24.
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Notes on an EPROM simulator, improved disk-based assemblers, Speak and Spell Interface, etc.
- Zunchak, Gene, "Nuts and Volts," pg. 9-14.
All about the 6502 Read/Write timing, Intertacing, Access Time, etc.
- Day, Michael E., "RS232 Communications: Part 1," pg. 16-18.
Learn all about the use of RS232 interfaces to connect communications devices together.
- Stone, Harold, R., "An Upgrade for KIM Microchess 1.0," pg. 19-23.
Modify the Microchess 1.0 to play a better game of chess.
- Ditts, Joseph A. and Herman, Harvey B., "Program Transfers (PET to KIM)," pg. 25-26.
Using this transfer routine you can use Basic PET programs on your KIM.
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Part 1: Implementing the IEEE-488 Bus on a SYM-1.
- McCreary, Dann, "COSAPPLE, an 1802 Simulator for the Apple II," pg. 34.
COSAPPLE is an 1802 simulator and debugger designed to run on the Apple.
- McCreary, Dann, "COSMAC: KIM-1 1802 Simulator," pg. 34.
This 1802 simulator is capable of real-time operations of moderate speed.
- Sandlin, Larry, "Fun with the 1802," pg. 34-35.
Have fun with the low cost, low power consumption 1802.
- Lock, Robert, "The Serious Side of the 1802," pg. 35.
Applications for the 1802 will be published in the future installments.
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- Oliva, Richard F., "Printing a Symbol Table for the AIM-65," pg. 40.
In revising a program, a print-out of the symbol table can be very helpful."
- Sproul, Keith, "Hard Copy Graphics for the KIM," pg. 43-46.
With a bit-mapped video board you can do professional quality graphics.
- Mackay, A.M., "24 Hour Clock for SYM-1 Basic," pg. 46-48.
With this program you can have a time-of-day clock.
- Stantford, Charles, L., "Screen Clear Routines for the OSI C1P," pg. 49-50.
Speed up the screen clear routines.

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